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VIA EMAIL

Mr. Bakul Patel
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Food and Drug Administration
10903 New Hampshire Ave., Bldg. 66, Rm. 5456
Silver Spring, MD 20993-0002

Re: Comments to FDA's Draft Guidance on Mobile Medical Applications: Docket No. FDA-2011-D-0530

Dear Bakul:

The members of the mHealth Regulatory Coalition ("MRC" or "Coalition") thank you for the opportunity to respond to the Notice of Availability ("NOA") published by the U.S. Food & Drug Administration ("FDA" or "Agency") in the Federal Register on July 21, 2011.[1] In the NOA, the Agency requested comments on *Draft Guidance for Industry and Food and Drug Administration Staff: Mobile Medical Applications* ("Draft Guidance")[2] and on two specific open issues: regulation of accessories and clinical decision support ("CDS") software. This letter details the Coalition's comments. In short, the Coalition believes that the FDA has taken a significant step toward the appropriate regulation of mobile health ("mHealth")[3] technologies, but there is more work to be done. While others may suggest that FDA

[1] Draft Guidance for Industry and Food and Drug Administration Staff; Mobile Medical Applications; Availability, 76 Fed. Reg. 43,689 (July 21, 2011), *available at* http://www.gpo.gov/fdsys/pkg/FR-2011-07-21/pdf/2011-18537.pdf [hereinafter Draft Guidance NOA].

[2] CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., DRAFT GUIDANCE FOR INDUSTRY AND FOOD AND DRUG ADMINISTRATION STAFF: MOBILE MEDICAL APPLICATIONS (2011), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM263366.pdf [hereinafter DRAFT GUIDANCE].

[3] The *m* in *mHealth* is an abbreviation for *mobile* to recognize the integration of mobile technology in healthcare today. The technologies that fall within the scope of the mHealth space include hardware and software products that fall within the traditional medical device realm as well as products that would otherwise be viewed as general purpose products (e.g., consumer products or IT devices). A simple example of technologies in a system that falls within the scope of mHealth is a tablet computer that includes a software app that integrates data from a blood

regulation of mobile medical apps and other mHealth products is not appropriate at this time—with some requesting that FDA withdraw its guidance document for further consideration of the impact of regulation on the industry—we believe that clear, predictable, and narrowly-tailored regulation is necessary to ensure patient safety and to promote innovation.

In addition to the comments enumerated in this letter, we have enclosed four attachments:

1) The original Draft Guidance with specific comments from the Coalition embedded throughout the document.
2) An edited version of the Draft Guidance that describes our suggested changes and the proposal for the final mobile medical apps guidance. To this end, in the edited Draft Guidance we have made an effort to narrow the scope of our proposed guidance to specifically focus on mobile medical apps.
3) A whitepaper the Coalition published describing the challenges faced by applying the existing regulatory approach to mHealth products and the issues that must be addressed as FDA embarks on the regulation of the mHealth industry.
4) Finally, a proposed guidance document that describes how we believe the regulatory framework should be applied to mHealth products, including hardware, stand-alone software, and mobile medical apps. Although this proposed guidance involves the regulation of mHealth products beyond the scope of the mobile medical apps Draft Guidance, we offer it for completeness and to demonstrate the areas that we believe FDA needs to continue to develop a regulatory framework.

The mHealth Regulatory Coalition

The MRC, which formed in July 2010, is a diverse group of mHealth non-governmental representatives, non-profit associations, patient advocacy organizations, healthcare payors and individual as well as integrated healthcare providers. Industry members include traditional medical device manufacturers, mobile app developers, online marketplaces for mobile apps, mobile platform manufacturers, telecommunications service providers, and information and communications technology companies, such as:[4]

- AgaMatrix
- Alternative Universe Technologies
- AT&T
- Boston Scientific
- Continua Health Alliance
- Extension, Inc.
- Fio Corp.
- Ideal Life Online
- Great Call (pka Jitterbug)
- Kaiser Permanente
- MedApps
- Medical Graphics Corp.
- Nokia
- OmniScience Mobile
- Partners/Ctr. for Connected Health
- Philips
- Qualcomm Incorporated
- Regulatory & Clinical Research Inst.
- Roche
- TechAmerica Foundation
- Verizon Wireless
- View720.com
- Voxiva
- WellDoc
- Willow Inc.
- Zoll Data Systems
- Massive Health

glucose meter, weight scale, and a blood pressure cuff. Other mHealth systems may integrate other types of home-use or implantable medical devices (e.g., infusion pumps or pacemakers). For additional information on the scope of mHealth technologies, see BRADLEY MERRILL THOMPSON ET AL., A CALL FOR CLARITY: OPEN QUESTIONS ON THE SCOPE OF FDA REGULATION OF MHEALTH (2010), *available at* http://mhealthregulatorycoalition.org/wp-content/uploads/2010/12/mrcwhitefinal122210.pdf.

[4] The Coalition membership continues to grow as our existence and purpose becomes more widely understood. This list does not include the names of individual members who are not associated with a specific organization.

The purpose of the Coalition is to propose a means by which FDA can tailor and apply its existing regulatory framework to mHealth technologies. To achieve this goal, the MRC has spent the last year identifying the challenges with the existing regulatory scheme and developing a proposed guidance document describing the approach that FDA should take in identifying what types of mHealth products should be regulated and at what classification. In December 2010, we published a whitepaper that defined the challenges after having spent nearly five months meeting internally and with external stakeholders (e.g., entrepreneurs and the medical device industry) to learn about their mHealth regulatory position and business plans.[5] Subsequently, the Coalition developed its proposed guidance, which covers areas such as 1) identifying intended use claims that a manufacturer can make about an mHealth product without crossing into regulated territory, 2) updating the traditional approach to the regulation of accessories, and 3) clarifying the regulation of software in an mHealth system.

Throughout the nine-month development process, the Coalition has solicited comments on the proposed guidance from other stakeholders and the public. We have posted drafts of the proposed guidance on the MRC's website (www.mhealthregulatorycoalition.org) and distributed it through various social media avenues (e.g., LinkedIn and MobiHealthNews.org). As a result, the Coalition's efforts have caught the attention of mainstream medical device news outlets such as *The Gray Sheet* and *FDANews*, among others. In addition to these public efforts, the MRC held an open meeting at the Continua/ATA Policy Summit in July 2011, during which we presented the proposed guidance and received a number of helpful comments. The Coalition has made an effort to incorporate all comments into the proposed guidance to present a consensus view of the appropriate regulatory framework for mHealth technologies.

Although membership in the Coalition for industry organizations requires a nominal fee to cover the costs associated with developing the proposed guidance, we do not require payment of dues for non-profit associations, patient advocacy organizations, or individual healthcare providers to encourage their participation. For these reasons, we believe that the proposed guidance represents a wide array of perspectives and is the result of an open and transparent process.

This diverse view does not, however, equate to a divided one. In fact, the members of the MRC share a unified view that patient safety must never be compromised. We recognize and respect the Agency's mission to ensure that medical devices marketed in the United States meet a high standard of safety and effectiveness. We believe this mission can be achieved while remaining consistent with the recent call from the Obama Administration to eliminate duplicative or unnecessary regulations.[6] In this regard, we highlight the need to narrowly tailor FDA's regulatory framework for mHealth products to prevent unnecessary and to promote innovation. Given the complexity of mHealth systems, FDA needs to

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[5] THOMPSON ET AL., *supra* note 3.

[6] Exec. Order No. 13,563, 76 Fed. Reg. 3821 (Jan. 21, 2011), *available at* http://www.gpo.gov/fdsys/pkg/FR-2011-01-21/pdf/2011-1385.pdf. The general principle established in this presidential order is described as the following:

> Our regulatory system must protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and job creation. It must be based on the best available science. It must allow for public participation and an open exchange of ideas. It must promote predictability and reduce uncertainty. It must identify and use the best, most innovative, and least burdensome tools for achieving regulatory ends. It must take into account benefits and costs, both quantitative and qualitative. It must ensure that regulations are accessible, consistent, written in plain language, and easy to understand. It must measure, and seek to improve, the actual results of regulatory requirements.

Id.

establish a clear, predictable, and targeted regulatory framework.[7] Through its leadership, FDA should strive to create a framework that:

- Promotes innovation and discovery of new ways to improve the delivery of care;
- Reduces the cost of healthcare;
- Facilitates private investment in the mHealth industry by large and small businesses; and
- Stimulates job creation in the United States.

The Coalition believes its proposed guidance balances the need to ensure patient safety with these other factors. For example, by limiting regulation of mHealth products to only those that involve moderate- to high-risk, the Agency will promote patient choice, which not only engenders innovation but drives down the cost of healthcare through competitive efficiencies in the market.

Comments on the Draft Guidance

In reviewing the Draft Guidance, the Coalition has identified a number of areas that require additional attention and clarity to ensure appropriate regulation of mHealth technologies. The following comments reflect areas that require the greatest attention as the FDA finalizes the Draft Guidance.

1. Clarity of Intended Uses

We believe that approach to evaluating intended uses of a product articulated in the Draft Guidance is too broad and would result in unnecessary regulation of mHealth technologies. Instead, the FDA should focus regulation on moderate- to high-risk devices, exempting or excluding low-risk products. For example, we agree with the FDA that general health and wellness products, electronic health records ("EHRs"), personal health records ("PHRs"), and general IT products should not be regulated.[8] In addition to these products, many other mHealth products either do not fall within the definition of a medical device under the Federal Food, Drug, and Cosmetic Act (FDCA)[9] or involve such low risk that the FDA should not focus its limited resources on them. The MRC's proposed guidance suggests specific criteria that the FDA can use to determine whether an mHealth product, based on its intended use claims, should be unregulated.[10]

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[7] FDA Commissioner, Dr. Margaret Hamburg, has agreed with this principle. In a joint statement on wireless medical devices, Dr. Hamburg and FCC Chairman Julius Genachowski stated the following:

> The American public—including industry, providers, patients, and other interested stakeholders—should have clear regulatory pathways, processes, and standards to bring broadband and wireless-enabled medical devices to market. This includes clarity regarding each agency's scope of authority with respect to these devices, predictability regarding regulatory pathways, and streamlining the application process, as appropriate, to facilitate innovation while protecting patients.

U.S. FOOD & DRUG ADMIN. & FED. COMMC'NS COMM'N, JOINT STATEMENT ON WIRELESS MEDICAL DEVICES (2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-300200A1.pdf.

[8] *See* DRAFT GUIDANCE, *supra* note 2, at 10–11 (listing electronic health records and personal health records as "mobile apps that FDA does not consider to be mobile medical apps"); *Medical Devices; Medical Device Data Systems*, 76 Fed. Reg. 8637, 8643 (Feb. 15, 2011) (to be codified at 21 C.F.R. § 880.6310), *available at* http://www.gpo.gov/fdsys/pkg/FR-2011-02-15/pdf/2011-3321.pdf [hereinafter *MDDS Final Rule*] ("By themselves, any system, or component of a system, that is solely intended for use as general IT equipment (and that is not intended for a device use under section 201(h) of the FD&C Act), would not be considered a medical device.").

[9] 21 U.S.C. § 321(h).

[10] For additional detail, see Sections V.A–.B of the proposed guidance and Section V.A of the edited Draft Guidance.

In addition to identifying specific types of products that will not be regulated, we request that the FDA clarify which intended uses ***will*** trigger regulation. In particular, the FDA should define terms such as *health* and *wellness* and clarify the boundary between a *health/wellness purpose* and a *medical use*. Moreover, the FDA should clarify how *consumer use*—as opposed to *professional use*—impacts whether a product is regulated. FDA also should clarify that the use of a standard communications protocol for interoperability with a medical device does not cause a general purpose device to become a regulated product.

Finally, in the final guidance, the FDA should address inconsistencies within the Agency that exist in the application of the current regulatory framework for mHealth technologies. In some instances, the FDA has allowed manufacturers of mHealth technologies to market their products based on general intended uses (e.g., "for home use"), while other manufacturers have been required to identify specific devices to which the mHealth technologies are intended to connect. This inconsistent application of the regulatory framework disadvantages manufacturers that must provide more specific statements of intended use. In particular, those manufacturers are subject to delays in the filing and review of submissions, additional user fees, delays in time-to-market, costs associated with additional filings, and restrictions on market potential of these products. In sum, the FDA's inconsistencies in the application of the regulatory framework have resulted in an uneven playing field, stifling innovation and contributing to the struggling U.S. economy.

2. Application of the Accessory Rule

The traditional approach to regulation of accessory devices has limited applicability in mHealth systems. Under the traditional accessory policy, the FDA regulates (in certain circumstances)[11] a product that is an accessory to a medical device and the medical device (the "parent") in the same regulatory classification. This approach is based on the theory that the risk associated with a failure in the accessory would be the same as if the parent medical device fails. In the world of mHealth, this theory does not always hold true. A more sound approach is to rely on 1) existing and future classifications for specific products within an mHealth system, and 2) claims substantiation.

Although the Coalition's proposed guidance describes this approach in detail, here is a brief summary of what we mean. Where a product falls squarely within an existing classification regulation, the product should be regulated in that classification, separate and apart from the applicable classification regulation for the parent device. These products should not be "up-regulated" based on the parent classification for two primary reasons. First, mHealth technologies involve a web of devices rather than a single device to which "accessories" connect, and second, failure of a single device in an mHealth system does not equate to failure of any other product in the system. The FDA can ensure that products within an mHealth system are compatible by requiring product manufacturers that make a claim of compatibility with other products to implement adequate controls (e.g., a quality system as well as verification and validation testing) that substantiate the claim. The burden here rests with the claim-maker, leaving the manufacturer of any other product in the mHealth system untouched by the regulatory obligations that result from the claims requiring substantiation. In this case, FDA should encourage the claim-maker to establish contractual relationships with manufacturers of other products in an mHealth system to facilitate the claim-maker's compliance obligations. If both manufacturers make claims of compatibility with the other, the regulatory burdens should be shared.

[11] Generally, FDA regulates a product as an accessory to (and in the same classification as) a specific medical device when the manufacturer of the product intends for it to be used with that medical device or when the medical device manufacturer requires the use of the product (which is sold separately) with that medical device.

To facilitate this proposed approach, FDA should develop new classification regulations for products in an mHealth system that otherwise would be treated as accessories. In addition, the FDA should clarify what premarket requirements apply to networks of multiple devices (i.e., an accessory connecting to more than one medical device), whether complying with an international standard for networked medical devices is sufficient to mitigate risk, and what types of evidence (e.g., a usability study) is required as part of premarket submissions (if applicable).

3. Roles and Responsibilities of Entities Involved in mHealth Systems

We believe that the complexity of an mHealth system—where a variety of medical devices and non-medical devices are interconnected—creates uncertainty as to the roles and responsibilities of each manufacturer of products in an mHealth system. In its simplest form, an mHealth system may involve a general purpose mobile platform and a mobile medical app; in more complex mHealth systems, there may be a variety of different medical devices and non-medical devices all interconnected directly or indirectly through one or more mobile platforms. The Draft Guidance does not adequately address the roles and responsibilities of entities involved in these complex mHealth systems. Therefore, we request that the FDA reconsider and clarify who is responsible for regulatory activities (i.e., pre- and post-market obligations) for mHealth systems that involve complex arrangements of medical devices and non-medical products.

The Draft Guidance does take some initial, important steps in this regard. For example, the Coalition agrees that anyone who initiates specifications, designs, labels, or creates a software system or application, or who commercially markets a hardware platform with an intended use as a device, is a device manufacturer.[12] As a device manufacturer, the entity is generally required to comply with a number of regulations.[13] Unless exempt, device manufacturers also must follow current good manufacturing practices[14] and, if applicable, submit a premarket notification or approval application. The MRC agrees with the FDA that a general mobile platform manufacturer should not be treated as a device manufacturer unless it intends the mobile platform to be used as a medical device or in connection with a medical device.[15]

However, the FDA's basis for this approach is somewhat confusing. The FDA states that a general mobile platform manufacture is a component manufacturer.[16] Under the FDCA, components are included within the definition of a medical device. In turn, the regulations define a component as "any raw material, substance, piece, part, software, firmware, labeling, or assembly which is intended to be included as part of the finished, packaged, and labeled device."[17] Manufacturers of components are unregulated not because the FDA has determined that these products do not meet the definition of a medical device, but because the FDA has exercised its enforcement discretion and shifted the regulatory burden to the finished device manufacturer. For a microchip that is sold to a pacemaker manufacturer, this concept works well. The component rules do not apply, however, for a smartphone manufacturer that

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[12] *See* DRAFT GUIDANCE, *supra* note 1, at 9 (providing examples of activities that the FDA attributes to mobile medical app manufacturers).

[13] These regulations include, among other things, establishment registration and listing (21 C.F.R. pt. 807), medical device reporting (21 C.F.R. pt. 803), product labeling (21 C.F.R. pt. 801), corrections and removals (21 C.F.R. pt. 806), and any special controls that apply.

[14] 21 C.F.R. pt. 820.

[15] *See* DRAFT GUIDANCE, *supra* note 1, at 10 ("[A] a mobile platform manufacturer that solely distributes or markets its platform with no device intended use is considered a component manufacturer . . . .").

[16] *Id.*

[17] 21 C.F.R. § 820.3(c).

sells its product to a consumer who later chooses to download a mobile medical app. The smartphone in this example does not meet the FDA's definition of a component because the smartphone is not a raw material intended to be included as part of a finished medical device. Instead, the smartphone is a finished, general-purpose mobile platform, which in any other situation would not be subject to FDA regulation. The FDA should clarify this inconsistency to prevent any confusion.

The FDA also should modify its approach to regulation of online marketplaces. The MRC does not believe that online marketplaces should be treated as distributors as is proposed in the Draft Guidance.[18] Instead, FDA should treat app stores as unregulated entities. An app store (e.g., iTunes, Android Market, or Blackberry App World) is analogous to a shopping mall that is composed of many stores that distribute their own products. In this way, an app store is an online marketplace that simply provides a venue for individual device manufacturers to sell their apps. Like a store in a shopping mall, the app manufacturer is responsible for the distribution of its products. The mere fact that an app store contains mobile medical apps should not cause FDA to treat the app store as a device distributor, which would impose certain regulatory burdens, including maintaining complaint files[19] and device tracking (if applicable).[20] The obligation to track and respond to complaints or problems with the app should fall on the entity manufacturing and distributing the app in the online marketplace, not to the online marketplace itself. This is simply too large of a burden for the app store to carry given that there may be tens of thousands of distinct mobile medical device apps in its marketplace. If subject to these burdens, app stores will restrict what types of mHealth apps are available, which will reduce the likelihood of investment and hamper innovation, potentially resulting in deleterious effects on public health.

App stores should, therefore, be unregulated and not treated as distributors of mobile apps. Similarly, companies that provide services (e.g., customer support services, data center hosting services, wireless connectivity, and app development kits[21]) for mHealth products should remain unregulated entities. The FDA should encourage app manufacturers to establish contractual relationships with app stores and service providers to facilitate compliance with the app manufacturers' regulatory obligations (e.g., complaint handling, adverse event reporting, etc.).

4. Regulation of Software in mHealth

A key principle of the Coalition's proposed guidance is the use of modularization in software to focus the Agency's regulatory oversight on aspects of mHealth software that impose moderate- to high-risk. The FDA should encourage the use of standard software design principles to facilitate modularization of mHealth apps, reducing regulatory burden on modules that have low risk or would otherwise be unregulated. The current regulatory approach for software does not stratify functionality within a software app or software system based on the applicable risk associated with specific functional modules. This creates a significant regulatory burden, particularly when considering the complexities of mHealth systems. These burdens can and should be alleviated through use of standard software design principles. In the proposed guidance, we describe a number of different approaches that may be considered.[22]

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[18] *See* DRAFT GUIDANCE, *supra* note 1, at 8–9 (stating that "entities that exclusively distribute mobile medical apps, without engaging in manufacturing functions" are considered distributors).
[19] 21 C.F.R. § 803.18(d).
[20] 21 C.F.R. § 821.30.
[21] Online marketplaces or other entities that provide basic app development kits should not be regulated if, for example, the kits are intended to enable compatibility with the underlying online marketplace itself (i.e., for distribution purposes).
[22] For additional detail, see Section VII.F.1 of the proposed guidance document.

In addition to modularization principles, we believe that FDA should consider developing classification regulations for mHealth software to facilitate appropriate risk-based regulation. The development of classification regulations is essential to achieve the appropriate level of regulatory oversight to ensure safety and effectiveness of software in mHealth systems. As noted above, these classification regulations will reduce the over-regulation that results from application of the traditional accessory rule. The Coalition has provided a number of classification regulations that we believe cover the various types of software that exist in mHealth systems now and into the foreseeable future. We have also developed a framework that the FDA can use to ensure that these classifications do not become obsolete as mHealth technology evolves.

Other Comments for FDA's Consideration

In addition to the comments above, the Coalition believes that FDA should consider the following as it finalizes the Draft Guidance and moves forward in further developing the regulatory framework for mHealth technologies more generally.

1. Promotion of Innovation

While the FDA is "responsible for protecting the public health by assuring the safety, efficacy and security of . . . medical devices," the FDA "is also responsible for advancing the public health by helping to speed innovations that make medicines more effective, safer, and more affordable . . . ."[23] To achieve these dual missions in regards to mHealth technologies, the FDA should provide more specificity around its approach to regulation of mHealth products and commit to promoting investment and innovation in the mHealth industry. We have noted above particular examples where innovation may be hindered as a result of provisions in the Draft Guidance and FDA's current approach to regulating mHealth technologies. One such example is the concern that mobile apps stores (and other unregulated entities involved in the mHealth industry) will exit the market or restrict development as a result of the Draft Guidance. The Coalition believes that the suggestions in the MRC's proposed guidance will provide the clarity needed to ensure patient safety and health, while also promoting investment in the mHealth industry, supporting the development of innovative technologies, and creating jobs across the United States.

2. Global Harmonization

The mHealth industry is a global one. While the FDA's reach is limited, the organizations that the Agency's regulations impact are vast. It is, therefore, important that the FDA work with global regulatory bodies to ensure harmonization of approaches to regulation of mHealth technologies. mHealth products are designed for use internationally and by working toward global harmonization, the FDA will streamline the regulatory burdens for all stakeholders. Through clarity and streamlining of global regulation, the FDA will facilitate investment, innovation, and job creation across the industry and ensure safety and effectiveness of medical devices in the United States.

3. Intrusion on the Practice of Medicine

It is well understood that the FDA does not regulate the practice of medicine. Although the modern computer only became available for common use three decades ago, many Americans have become adept at developing software and manipulating mobile devices for a variety of purposes. This phenomenon has

[23] U.S. Food & Drug Admin., *What We Do*, http://www.fda.gov/AboutFDA/WhatWeDo/default.htm (last visited Aug. 23, 2011).

resulted in a blurring of the lines between the practice of medicine and medical device manufacturing. For example, if a physician develops a software app for tracking her patient's behaviors between visits, is that a medical device or simply the practice of medicine? If a physician creates an ECG electrode that attaches to a smartphone, can he allow his patient to use it for twenty-four hours without the FDA considering that to be manufacturing and distribution of a medical device? We believe that the FDA should address concerns that the current approach to regulation of mHealth products is an intrusion on the practice of medicine. More specifically, the FDA should provide clear guidance regarding activities that it deems to be within its jurisdiction and those activities that it considers to be the practice of medicine.

4. EHRs and Health Information Exchanges (HIEs)

An area of significant growth in healthcare is the development and implementation of a national EHR network. It is only natural that medical device manufacturers and others in the mHealth industry will want to leverage the EHR network to improve the delivery of healthcare for its customers. Unfortunately the regulatory status of EHRs is currently unclear. On a number of occasions in the last two years, the FDA has stated in speeches that EHRs meet the definition of a medical device but that the Agency is exercising enforcement discretion at this time.[24] The Draft Guidance states that the FDA does not consider EHRs to be a mobile medical app;[25] however, the Draft Guidance does not elaborate further on the regulatory status of EHRs, nor does the Agency define what it considers to be an EHR. The Coalition requests that the FDA define *EHR* and definitively state whether the Agency intends to regulate them. If the Agency intends to regulate certain EHRs, we believe the FDA should clearly describe its regulatory approach. In particular, the FDA should clarify what characteristics cause an EHR to cross into regulated territory (e.g., whether manual as opposed to electronic data collection influences the regulatory decision) and how device classification will be determined. Similarly, the Agency should elucidate on the regulatory status of HIEs and whether the hardware and software involved in such systems are subject to FDA regulation. We believe that, like EHRs, HIEs should remain unregulated.

5. Scope of FDA Jurisdiction in mHealth

As you are well aware, mHealth technologies are inherently mobile and, therefore, involve wireless communications and associated legal and regulatory considerations that are beyond the authority of the FDA, including data privacy and radiofrequency spectrum regulation. We believe that the FDA should identify the scope of its jurisdiction, specifically limiting the Agency's role in these areas and harmonizing its authority with other regulatory bodies across the globe.

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[24] *See, e.g.*, Testimony of Jeff Shuren, Director of Ctr. for Devices & Radiological Health, U.S. Food & Drug Admin., before the Adoption/Certification Workgroup of the HIT Policy Committee (Feb. 25, 2010), *available at* http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_11673_910717_0_0_18/3Shuren_Testimony022510.pdf. FDA is considering several possible approaches to regulation of EHRs, including:

> 1) Focusing on post-market safety by requiring HIT device establishments to electronically register and list their HIT devices, and to submit Medical Device Reports (MDRs) to the FDA;
> 2) Focusing on manufacturing quality and post-market safety by requiring HIT device manufacturers to comply with the above requirements and also to adhere to FDA's Quality Systems Regulation (QSR); and
> 3) Applying the traditional regulatory framework, in which HIT device manufacturers would be required to meet all the same regulatory requirements as other, more traditional devices, including risk-based premarket review.

Id.

[25] DRAFT GUIDANCE, *supra* note 1, at 10–11.

Furthermore, the Agency should regularly inform the public on the status of collaborations (if any) with other regulatory agencies (e.g., the Federal Communications Commission (FCC), the Federal Trade Commission (FTC), and the Office of the National Coordinator (ONC) for Health Information Technology) so that all stakeholders are apprised of the regulatory landscape that applies to the mHealth industry. In particular, the FDA should update the public on the status of the memorandum of understanding (MOU) into which the FDA entered with the FCC in July 2010.[26] As stated in the MOU, the FDA and FCC agreed "to promote collaboration and ultimately to improve the efficiency of the regulatory processes applicable to . . . wireless enabled medical devices."[27] The agencies also agreed to a number of substantive activities, including holding joint public meetings and sharing information in order to "cooperatively identify and eliminate or reduce unnecessary hindrances . . . relate[d] to broadband and wireless enabled medical devices."[28] Since the announcement of this MOU over a year ago, neither the FDA nor the FCC has demonstrated to the public any efforts to achieve these goals. The Coalition strongly encourages that the FDA collaborate with FCC and other agencies that are involved in the regulation of mHealth technologies, while clearly defining the limits to its jurisdiction and ensuring that inter-agency collaboration does not result in bureaucratic backlog or over-burdensome regulation.

6. Creation of an mHealth-Specific Regulatory Division within the FDA

The Coalition strongly encourages the FDA to establish a division within the Agency that focuses on the regulation of mHealth products. We envision this division as having a dedicated staff that is responsible for reviewing submissions for mHealth products, responding to inquiries from industry, and educating Agency staff, including field investigators. The FDA could model this new division based on the structure of the Office of *In Vitro* Diagnostic Device Evaluation and Safety (OIVD) within the Center for Devices and Radiological Health (CDRH), which is responsible for pre- and post-market regulation of a specific type of medical devices (i.e., *in vitro* diagnostics). As noted above, there is a need for consistency within the FDA in the application of the regulatory framework to mHealth technologies.

One example of an inconsistency that occurs is the requirement that manufacturers comply with ISO 60601 requirements. An mHealth manufacturer that designs a proprietary mobile platform must comply with these safety standards just as any other regulated medical device; however, a manufacturer that develops a mobile medical app for use on an off-the-shelf smartphone is not required to comply with this standard because the smartphone is an unregulated, general-purpose article, so only the mobile medical app is subject to FDA regulation. The risk to the user may be the same, but the standards are not consistently applied because IT products (e.g., smartphones) are not otherwise subject to ISO 60601 requirements.

A division dedicated to mHealth products would greatly reduce these types of inconsistencies. In addition to the need for consistency within the Agency, a dedicated division will undoubtedly be necessary to address the large volume of mHealth-related inquiries and submissions that will flood the Agency once the Draft Guidance is finalized and as the Agency develops additional guidance that impacts the mHealth industry. Simply put, coalescing the knowledge experts within the FDA today will help provide the

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[26] MEMORANDUM OF UNDERSTANDING BETWEEN THE FEDERAL COMMUNICATIONS COMMISSION AND THE FOOD AND DRUG ADMINISTRATION CENTER FOR DEVICES AND RADIOLOGICAL HEALTH (2010), *available at* http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0726/DOC-300200A2.pdf [hereinafter FDA & FCC MOU]; *see also* U.S. FOOD & DRUG ADMIN. & FED. COMMC'NS COMM'N, *supra* note 7 ("The FDA and the FCC agree to build upon this initiative . . . to proactively serve the national interest in finding innovative solutions to America's health care challenges.").

[27] FDA & FCC MOU, *supra* note 26, at § IV.

[28] *Id.* at § VI.

necessary support for and regulation of an industry that is on pace to dramatically disrupt the medical device market in the United States.

MRC's Proposed Guidance and Changes to the Draft Guidance

In addition to the specific comments above, the Coalition is submitting our proposed guidance because we believe that the Draft Guidance requires much more clarity to ensure that only those mHealth products that warrant regulatory oversight are regulated. While we believe that FDA has taken great strides in developing the Draft Guidance, we submit the enclosed proposed guidance to provide necessary details that are missing. As mentioned before, to facilitate the communication of our specific comments, we also have edited and embedded comments in the Draft Guidance. We urge the FDA to consider the proposed guidance and the specific changes to the Draft Guidance in tandem as the Agency finalizes the Draft Guidance.

Response to FDA's Questions Posed in the NOA

The Coalition conclude our comments by providing direct responses to the questions posed in the NOA, as follows:

1. Accessories: *How should the Agency approach accessories and particularly mobile medical apps that are accessories to other medical devices so safety and effectiveness can be reasonably assured?*

We believe the traditional approach to regulation of accessory devices has limited applicability in mHealth systems. The Agency recognized this view in its NOA, proposing a new approach to regulating accessories.[29] Under the proposed scheme, FDA would regulate accessories based on three types of intended uses:

- **Type A:** Accessories that do not change the intended use of the connected device, but **aid in the use** of the connected medical device would be designated as **Class I**.
- **Type B:** Accessories that **extend the intended use** of the connected medical device would be **classified with the connected device**.
- **Type C:** Accessories that **create a new intended use** from that of the connected device(s) would be **classified according to the risk posed** to patient safety by the new intended use.

The Coalition has a number of concerns with the Agency's proposal. Specifically, the description for Type A is extremely broad and may result in the inappropriate regulation of certain medical devices. The Agency offered a stand for an infusion pump as an example of a Type A accessory because it merely aids in the use of the device. First, this example does not involve a mobile medical app. We encourage FDA to provide examples specific to mobile medical apps. Second, although we agree that the stand should be regulated separately from the infusion pump, the Coalition questions whether the "aid in the use" test is appropriately tailored to address the associated risk. In particular, the FDA's proposal for Type A accessories may result in moderate- to high-risk accessories being regulated as Class I devices. For example, a transducer that connects to a smartphone with a mobile ultrasound app is an accessory that aids in the use of the app.[30] The FDA's proposal for Type A accessories would result in the regulation of

[29] Draft Guidance NOA, *supra* note 1, at 43,689–90.

[30] A diagnostic ultrasonic transducer is regulated as a Class II medical device under 21 C.F.R. § 892.1570, while the mobile medical app would be regulated as a Class II ultrasonic imaging system under 21 C.F.R. § 892.1550 or § 892.1560.

the Class II transducer as a Class I device. We believe that down-classification in such situations would not be in the best interest of patient safety. Likewise, we believe that the proposal for Type A accessories will result in the up-regulation of general purpose articles that should not be regulated. For example, a phone jack splitter that connects to a remote monitoring system while allowing the user to also connect a standard telephone is a general purpose article that, when used as an "accessory", should not be subject to even Class I controls.

The Coalition has similar concerns regarding the scope of accessories included in Type B of FDA's proposed approach. For these accessories, the FDA provides the following example: a mobile medical app that performs more detailed analysis than the connected device while maintaining the original intended use (i.e., data analysis). First, the Agency should clarify when the accessory's intended use is an "extension" as opposed to a "new" intended use (as described for Type C accessories). Second, the Coalition questions whether all Type B accessories warrant the same level of regulation as the connected device. For example, a mobile medical app that connects to a blood pressure cuff (a Class II device) and trends the blood pressure readings over time or acts as a secondary display would be a Type B accessory but would involve sufficiently low risk that Class I general controls would be adequate. Under the FDA's proposal, the mobile medical app in this example would be unnecessarily up-regulated to a Class II designation. Similarly, a mobile medical app that performs data analysis within the scope of the intended use of the connected device but associated with greater risk might warrant a higher classification such that down-regulation would be inappropriate.

Given our concerns about Types A and B accessories, we believe that the approach described for Type C accessories most accurately reflects how the FDA should regulated accessories in an mHealth system—that is, accessories should be regulated based on their own associated risk, independent of the connected device. In proposing examples of the Type C accessories, the Agency suggested that a mobile medical app that is intended to provide, for example, disease-specific prognosis, and is connected to a device with a different intended use, the associated risk may be different from the connected device, warranting a different classification to assure safety and effectiveness of the mobile medical app. We agree that the mobile medical app in this example should be regulated independently from the connected device so that the mobile medical app is not unnecessarily up- or down-regulated. This approach, however, should not be limited to accessories that create a new intended use. Instead, the Agency should apply this risk-based approach to all types of accessories, including those that aid in the use of or extend the intended use of the connected device.

Finally, the proposed approach overlooks an important fourth type of products that connect to medical devices: those products that are not medical devices and should, therefore, remain unregulated. FDA should define this fourth type of accessory and clearly indicate that these accessories are not regulated. We believe that this fourth type of unregulated accessories includes hardware and software products that have not been associated with a medical device by virtue of their intended use. An example of an accessory that falls into this fourth type is a general purpose article (e.g., general communications equipment).

The cornerstone of our proposal to the regulation of accessories is the existence of classification regulations so that associated risk can be evaluated and the classification designation can be appropriately assigned based on that risk. To that end, we believe that the Agency must endeavor to establish new classification regulations rather than rely on its proposed approach, which results in drawing arbitrary lines between types of accessories and the misapplication of regulatory oversight. We understand, however, that the development of new classification regulations is an important task that takes several years to complete. During the interim, the Coalition would support the FDA's proposed approach with the following modifications:

- The Agency should modify the description of Type A accessories to "medical devices that are not reasonably expected to directly affect the safety and effectiveness of the medical device." An example of an accessory fitting this description is a mobile medical app that collects data from a blood glucose meter as a secondary display. Another example could be a phone jack splitter that connects to a remote monitoring system while allowing the user also to connect a standard telephone. Although the phone jack splitter is a general purpose article and should, therefore, not be regulated in most instances, we would support the regulation of the general purpose article as a Type A accessory (i.e., Class I) in the specific situation where the device manufacturer incorporates the general purpose article into a kit. Otherwise such general purpose articles (and other non-medical devices) should remain unregulated.

- All *regulated* accessories that do not fall within Type A should be treated as Type B accessories, unless the accessory changes the fundamental intended use of the connected device, in which case the accessory should be treated as Type C. To make this determination, the FDA could employ its approach for determining whether a new 510(k) would be required for an existing device. In particular, the Agency could focus the inquiry on whether the accessory "could significantly affect" the safety or effectiveness of the connected medical device or whether the accessory causes "a major change or modification in the intended use" of the connected device. The FDA proposed basic principles for making such a determination in a recently published draft guidance.[31] FDA should incorporate similar principles for determining whether a mobile medical app falls within Type B or C.

While we believe that these modifications are necessary, we cannot stress enough that they should be a temporary fix. Ultimately, FDA should rely on 1) existing and future classifications for specific products within an mHealth system and 2) claims substantiation. If a product falls squarely within an existing classification regulation, the product should be regulated in that classification, separate and apart from the applicable classification regulation for the connected device. The FDA can ensure that products within an mHealth system are compatible by requiring product manufacturers that make a claim of compatibility with other products in the mHealth system to implement adequate controls (e.g., a quality system as well as verification and validation testing) that substantiate the claim. The attached proposed guidance document describes our long-term recommendation in more detail.[32]

2. Clinical Decision Support Software: *What factors should FDA consider in determining the risk classification of different types of software that provide CDS functionality? How should FDA assess stand-alone software that provides CDS functionality, to assure reasonable safety and effectiveness? Are there specific controls that manufacturers should implement that could change the risk classification or reduce the premarket data requirements for particular types of stand-alone software that provide CDS functionality?*

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[31] CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., DRAFT GUIDANCE FOR INDUSTRY AND STAFF: 510(K) DEVICE MODIFICATIONS: DECIDING WHEN TO SUBMIT A 510(K) FOR A CHANGE TO AN EXISTING DEVICE (2011), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM265349.pdf.

[32] The edited FDA guidance document that we have included as an attachment to this letter contains a discussion of the regulation of accessories. Although we have proposed in this letter a near-term as well as a long-term approach to the regulation of accessories, we have only incorporated the long-term approach in the edited FDA guidance document. If FDA chooses to implement our suggested near-term solution, we recommend that the Agency include the details of that solution in place of the long-term solution in that document.

As an initial response, we believe that the Agency has not provided adequate detail with respect to its current thinking on the regulation of CDS software. The Draft Guidance specifically indicates the FDA's intent to publish future guidance for CDS software. Hence, any request for comments on the regulation of CDS software is not ripe and any discussion and inclusion in the finalized guidance of examples that involve CDS software should be removed. The Agency should consider the regulation of CDS software holistically in the context of other regulated software to maintain consistency in the regulatory approach and to prevent any confusion. Beyond recommending these fundamental changes, the Coalition does not believe that comments are appropriate at this time, and we reserve our right to comment on future CDS guidance.

Nonetheless, we believe that FDA must clearly define the term *CDS functionality*. The NOA requests comments on "stand-alone software (mobile or traditional workstation) that analyzes, processes, or interprets medical device data (collected electronically or through manual entry of the device data) for purposes of automatically assessing patient specific data or for providing support in making clinical decisions."[33] Standing alone, this description does not adequately define what FDA considers to constitute CDS functionality. For example, FDA does not define *medical device data*, which is essential to understanding the scope of the question. Furthermore, more clarity as to how the Agency defines *support* in relation to a clinical decision is critical.

Since the publication of the NOA, the FDA seems to have broadened its thinking on the regulation CDS software. In the recent FDA public workshop on mobile medical apps, the Agency presented a preliminary definition,[34] dedicating a half-day session to discussion of the topic. FDA described the workshop definition of CDS software as the following: any software, whether designed as "a mobile application, web-based service or desk top application," that "[u]ses an individual's information from various sources (electronically or manually entered)" and that "[c]onverts this information into new information that is intended to support a clinical decision."[35] The workshop definition is much broader than the scope presented in the NOA. For example, the NOA limits the scope to interpretation of medical device data. The workshop definition, however, extended the scope to include interpretation of *any* "actionable information" from virtually *any* source. Although the workshop definition limits CDS software to use of an individual's information, the examples provided are not limited to interpretation of patient-specific data. For example, according to the Agency, software that interprets environmental data (e.g., pollen count or ambient temperature) for use in the clinical decision-making process would meet the definition of a medical device.[36] We believe that the scope of this preliminary definition is unnecessarily broad. FDA should reconsider and provide a clear definition that focuses on software that involves moderate- to high-risk.

Despite such uncertainty, the MRC proposed guidance establishes the regulatory framework that we believe FDA should implement for stand-alone software in an mHealth system. In brief, we believe software (whether stand-alone, mobile, or web-based apps) should be regulated based on risk associated with its intended use. More specifically, FDA's traditional *Level of Concern* approach should be used for regulation of software in an mHealth system.[37] For example, a software app that is intended to allow a

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[33] *Id.* at 43,690.

[34] Kristen Meier, Mathematical Statistician, Ctr. for Devices & Radiological Health, U.S. Food & Drug Admin., Standalone Clinical Decision Support (CDS) (Sept. 13, 2011), *available at* http://www.fda.gov/downloads/MedicalDevices/NewsEvents/WorkshopsConferences/UCM271894.pdf.

[35] *Id.* at 2.

[36] *Id.* at 4.

[37] *See* CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., GUIDANCE FOR THE CONTENT OF PREMARKET SUBMISSIONS FOR SOFTWARE CONTAINED IN

healthcare professional to monitor Class II or III device data or patient activity for diagnosis or treatment of a moderate- or high risk-disease should be regulated as a Class II or III device (depending on the specific risks associated with the software). On the other hand, a software app that is intended to track and report activity for treatment of a low-risk disease should be regulated as a Class I device. At the same time, other software apps may involve such low risk that they should not be regulated at all. The proposed guidance describes a risk model that can be used to determine risk associated with such software as well as criteria for determining when an intended use involves such low risk that the product should be exempted or excluded from FDA regulation.

The Coalition's proposed guidance describes other considerations of which FDA should take note when finalizing the Draft Guidance and developing its approach for CDS software. In particular, we propose that FDA establish a number of new classification regulations that specifically define certain software types and identify their associated device classification. We also propose that FDA embrace the use of good software principles such that software may be regulated as independent modules at the system-, app-, and sub-app level, including modules that are capable of reuse across mHealth systems. Finally, FDA should restrict its use of the 8xx.9 limitations on exemption from premarket notification requirements in regards to such software.

While the Coalition believes that it is inappropriate to address these issues in the mobile medical apps guidance, the FDA should move quickly to develop guidance that brings clarity to the entire mHealth ecosystem, including regulation of CDS software, to prevent a void in the regulatory framework.

Conclusion

FDA must provide a clear, predictable, and appropriately calibrated regulatory framework for mHealth technologies lest it risks stifling innovation, reducing investment, restricting job creation, limiting patient choice, increasing cost of healthcare, and—most importantly—endangering patient safety. In the attached documents, the MRC proposes changes to the Draft Guidance that we believe adequately balances the public and private interests in this regard. To be clear, the Coalition is not proposing to establish a new classification scheme for mHealth products; instead, our proposal tailors the existing regulatory framework to mHealth products, including identifying a number of product types that might fall within mHealth systems for which there does not currently exist classification regulations.

Thank you for the opportunity to submit these comments and the enclosed documents on behalf of the Coalition. Please do not hesitate to contact me if you have any questions.

Sincerely,

Bradley Merrill Thompson
On Behalf of the mHealth Regulatory Coalition

MEDICAL DEVICES 4–8 (2005), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm089593.pdf; CTR. FOR DEVICES & RADIOLOGICAL HEALTH, U.S. FOOD & DRUG ADMIN., GUIDANCE FOR INDUSTRY, FDA REVIEWERS AND COMPLIANCE ON OFF-THE-SHELF SOFTWARE USE IN MEDICAL DEVICES (1999), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073779.pdf.

Attachment A:
Original FDA Draft Guidance with
Comments from the MRC

Contains Nonbinding Recommendations
Draft – Not for Implementation

Draft Guidance for Industry and Food and Drug Administration Staff

Mobile Medical Applications

DRAFT GUIDANCE

This guidance document is being distributed for comment purposes only.

Document issued on: July 21, 2011

You should submit comments and suggestions regarding this draft document within **90** days of publication in the *Federal Register* of the notice announcing the availability of the draft guidance. Submit written comments to the Division of Dockets Management (HFA-305), Food and Drug Administration, 5630 Fishers Lane, rm. 1061, Rockville, MD 20852. Submit electronic comments to http://www.regulations.gov. Identify all comments with the docket number listed in the notice of availability that publishes in the *Federal Register*.

For questions regarding this document, contact Bakul Patel at 301-796-5528 or by electronic mail at Bakul.Patel@fda.hhs.gov . For questions regarding this document concerning devices regulated by CBER, contact the Office of Communication, Outreach and Development (OCOD), by calling 1-800-835-4709 or 301-827-1800.

U.S. Department of Health and Human Services
Food and Drug Administration

Center for Devices and Radiological Health

Center for Biologics Evaluation and Research

Preface

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CDRH

Additional copies are available from the Internet. You may also send an e-mail request to dsmica@fda.hhs.govto receive an electronic copy of the guidance or send a fax request to 301-827-8149 to receive a hard copy. Please use the document number (1741) to identify the guidance you are requesting.

CBER

Additional copies of this draft guidance are available from the Office of Communication, Outreach and Development (OCOD) (HFM-40), 1401 Rockville Pike, Suite 200N, Rockville, MD 20852-1448, or by calling 1-800-835-4709 or 301-827-1800, or from the Internet at http://www.fda.gov/BiologicsBloodVaccines/GuidanceComplianceRegulatoryInformation/Guidances/ default.htm

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Contains Nonbinding Recommendations
Draft – Not for Implementation

Draft Guidance for Industry and Food and Drug Administration Staff

Mobile Medical Applications

This draft guidance when finalized will represent the Food and Drug Administration's (FDA's) current thinking on this topic. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. You can use an alternative approach if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative approach, contact the FDA staff responsible for implementing this guidance. If you cannot identify the appropriate FDA staff, call the appropriate number listed on the title page of this guidance.

I. Introduction

The Food and Drug Administration (FDA) is issuing this draft guidance document to inform manufacturers, distributors, and other entities about how the FDA intends to apply its regulatory authorities to select software applications intended for use on mobile platforms (mobile applications or "mobile apps").

Given the rapid expansion and broad applicability of mobile apps, the FDA is issuing this draft guidance document to clarify the types of mobile apps to which the FDA intends to apply its authority. At this time, the FDA intends to apply its regulatory requirements solely to a subset of mobile apps that it is calling mobile medical applications or "mobile medical apps."

FDA's guidance documents, including this guidance, do not establish legally enforceable responsibilities. Instead, guidances describe the Agency's current thinking on a topic and should be viewed only as recommendations, unless specific regulatory or statutory requirements are cited. The use of the word "should" in Agency guidances means that something is suggested or recommended, but not required.

II. Background

A growing number of software applications are being developed for use on mobile platforms, which include smart phones, tablet computers, and personal digital assistants. As these mobile platforms become more user friendly, computationally powerful, and readily available, innovators have begun to develop mobile apps of increasing complexity to leverage the portability mobile platforms can offer. Some of these new mobile apps are specifically targeted to assisting individuals in their own health and wellness management. Other mobile apps are targeted to healthcare providers as tools to improve and facilitate the delivery of patient care.

In 1989, FDA prepared a general policy statement on how it planned to determine whether a computer-based product and/or software-based product is a device, and, if so, how the FDA intended to regulate it. The document, "FDA Policy for the Regulation of Computer Products, became known as the "Draft Software Policy." After 1989, however, the use of computer and software products as medical devices grew exponentially and the types of products diversified and grew more complex (and that trend has continued). As a result, the FDA determined that it would be impractical to prepare an overarching software policy to address all of the issues related to the regulation of all medical devices containing software. Therefore, the Draft Software Policy was withdrawn.[1]

Although the FDA has not issued an overarching software policy, the Agency has formally classified certain types of software applications that meet the definition of a device and, through classification, identified specific regulatory requirements that apply to these devices and their manufacturers. These software devices include products that feature one or more software components, parts, or accessories (such as electrocardiographic (ECG) systems used to monitor patient activity), as well as devices that are composed solely of software (such as laboratory information management systems). On February 15, 2011, the FDA issued a regulation down-classifying certain computer- or software-based devices intended to be used for the electronic transfer, storage, display, and/or format conversion of medical device data – called Medical Device Data Systems (MDDSs) – from Class III (high-risk) to Class I (low-risk).[2]

Moreover, the FDA has previously clarified that when standalone software is used to analyze medical device data, it has traditionally been regulated as an accessory to a medical device[3] or as medical device software.

As is the case with traditional medical devices, mobile medical apps can pose potential risks to public health. Moreover, mobile medical apps may pose additional or different risks due to the

Comment [jb1]: FDA should clarify what are the additional or different risks associated with mobile apps.

[1] 70 FR 824 at 890 (January 5, 2005) Federal Register Notice [Docket No 1998N-0046], http://edocket.access.gpo.gov/2005/pdf/05-155.pdf.
[2] 76 FR 8637 (Feb. 15, 2011), Final Rule.
[3] See, for example, Content of a 510(k) -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/PremarketSubmissions/PremarketNotification510k/ucm142651.htm) ("Accessories to classified devices take on the same classification as the "parent" device. An accessory such as software that accepts input from multiple devices usually takes on the classification of the "parent" device with the highest risk, i.e., class."); Final Rule, Medical Devices, Medical Device Data Systems, 76 Fed. Reg. 8637, 8643-8644 (Feb. 15, 2011).

unique characteristics of the platform. For example, the interpretation of radiological images on a mobile device could be adversely affected by the smaller screen size, lower contrast ratio, and uncontrolled ambient light of the mobile platform; FDA intends to take these limitations into account in assessing the appropriate regulatory oversight for these products.

This guidance clarifies and outlines the FDA's current thinking. The Agency will continue to evaluate the potential impact these technologies might have on improving health care, reducing potential medical mistakes, and protecting patients.

Comment [jb2]: FDA should describe how these differences affect the regulation of the device as compared to a software app that is identical in function but is designed for a laptop or desktop.

Comment [jb3]: How? What will FDA do with this information?

III. Definitions

A. Mobile Platform

For purposes of this guidance, "mobile platforms" are defined as commercial off-the-shelf (COTS) computing platforms, with or without wireless connectivity, that are handheld in nature. Examples of these mobile platforms include mobile computers such as the iPhone®, BlackBerry® phones, Android® phones, tablet computers, or other computers that are typically used as smart phones or personal digital assistants (PDAs).

B. Mobile Application (Mobile App)

For purposes of this guidance, a mobile application or "mobile app" is defined as a software application that can be executed (run) on a mobile platform, or a web-based software application that is tailored to a mobile platform but is executed on a server.

C. Mobile Medical Application (Mobile Medical App)

For purposes of this guidance, a "mobile medical app" is a mobile app that meets the definition of "device" in section 201(h) of the Federal Food, Drug, and Cosmetic Act (FD&C Act)[4]; and either:

- is used as an accessory to a regulated medical device; or
- transforms a mobile platform into a regulated medical device.

The intended use of a mobile app determines whether it meets the definition of a "device." As stated in 21 CFR 801.4,[5] intended use may be shown by labeling[6] claims, advertising materials,

[4] Products that are built with or consist of computer and/or software components or applications are subject to regulation as devices when they meet the definition of a device in section 201(h) of the FD&C Act. That provision defines a device as "…an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent…..", that is "…intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man…" or "…intended to affect the structure or any function of the body of man or other animals…" Thus, software applications that run on a desktop computer, laptop computer, remotely on a website or "cloud," or on a handheld computer may be subject to device regulation if they are intended for use in the diagnosis or the cure, mitigation, treatment, or prevention of disease, or to affect the structure or any function of the body of man. The level of regulatory control necessary to assure safety and effectiveness varies based upon the risk the device presents to public health. (See Appendix B for examples).

[5] "The words 'intended uses' or words of similar import … refer to the objective intent of the persons legally responsible for the labeling of devices. The intent is determined by such persons' expressions or may be shown by the circumstances surrounding the distribution of the article. This objective intent may, for example, be shown by labeling claims, advertising matter, or oral or written statements by such persons or their representatives. It may be shown by the circumstances that the article is, with the knowledge of such persons or their representatives, offered and used for a purpose for which it is neither labeled nor advertised. The intended uses of an article may change after it has been introduced into interstate commerce by its manufacturer. If, for example, a packer, distributor, or seller intends an article for different uses than those intended by the person from whom he received the devices, such packer, distributor, or seller is required to supply adequate labeling in accordance with the new intended uses. But if a manufacturer knows, or has knowledge of facts that would give him notice that a device introduced into interstate commerce by him is to be used for conditions, purposes, or uses other than the ones for which he offers it,

Comment [jb4]: How does FDA intend to regulated proprietary computing platforms that are used in mobile health systems? For example, a proprietary hand-held device that uses Android OS and allows multiple mHealth products to connect to it?

Comment [jb5]: FDA should clarify how it intends to regulate a web-based software app with the same intended uses as a mobile app but that is not specifically designed for a mobile platform. For example, if a web-based software app meets the definition of a medical device and is viewable on a mobile platform, but not specifically designed for use on a mobile platform, is this app regulated differently from an identical app that is designed for use on a mobile platform? If so, how and why?

Comment [jb6]: In FN4, for the sentence that begins "The level of regulatory control…", how does FDA intend to address risk for mobile apps and how does this differ from risk assessments for software designed for use on a desktop, laptop, remote website, or "cloud"?

Comment [jb7]: The reference to"transforms a mobile platform into a regulated medical device" is a bit confusing because it seems to suggest that the mobile platform is regulated. Is this FDA's intention even if the platform manufacturer is intended to be a general purpose device? Does knowledge that users may download a mobile medical app onto the otherwise general purpose platform cause the general purpose platform to become a regulated device? The FDA seems to suggest that the general purpose platform remains unregulated (or rather is treated as a component manufacturer—see pg. 10, ln. 3-13), but this is not clear.

Comment [jb8]: In FN5, in regards to the reference to the "persons legally responsible for the labeling of devices", does the interconnectedness of devices in an mHealth system impact who is legally responsible for the labeling of devices? What are the limits on implied intended uses for a device as a result of, for example, using an interoperability standard? What's the impact of using an interoperability standard and having claims made about a device by a manufacturer of another interoperable device?

In regards to the last sentence in the footnote, what labeling is adequate to cover the infinite number of possible uses when a device is designed to an interoperability standard? Is it sufficient to say that the device is designed based on the interoperability standard?

or oral or written statements by manufacturers or their representatives. When the intended use of a mobile app is for the diagnosis of disease or other conditions, or the cure, mitigation, treatment, or prevention of disease, or is intended to affect the structure or any function of the body of man, the mobile app is a device.

One example is a light emitting diode (LED) included on a mobile platform with a mobile app to make that LED operate. If the manufacturer intends the system to illuminate objects generally (i.e., without a specific device intended use), neither the mobile app nor the mobile platform would be considered medical devices. If, however, through marketing and distribution, the mobile app is promoted by the manufacturer for use as a light source to examine patients, then the mobile app would meet the definition of a device. (In this case, the intended use of the light source would be similar to a conventional device such as an ophthalmoscope.)

In general, if a mobile app is intended for use in performing a medical device function it is a medical device, regardless of the platform on which it is run. For example, mobile apps intended to run on smart phones to analyze glucose meter readings would be considered similar to software running on a desktop computer, which is regulated under 21 CFR 862.1345 ("glucose test system").

Comment [jb9]: FDA should clarify whether the mobile app version would be regulated differently from the desktop version. If regulated differently, FDA should clarify why.

D. Regulated Medical Device

For purposes of this guidance, a "regulated medical device" is defined as a product that meets the definition of "device" in section 201(h) of the FD&C Act and that has been classified by the FDA, or otherwise approved or cleared by the FDA review of a premarket application or other submission for the device. Examples of such devices are identified in Appendix B.

E. Mobile Medical App Manufacturer

For purposes of this guidance, a "mobile medical app manufacturer" is defined as any person or entity that manufactures mobile medical apps in accordance with 21 CFR Parts 803, 806, and 807.[7] This term does not include entities that exclusively distribute mobile medical apps, without

Comment [jb10]: FDA should clarify the definition of a device manufacturer because this suggests that a person who manufactures a mobile app NOT in accordance with 21 CFR Parts 803, 806, and 807 is NOT a device manufacturer.

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he is required to provide adequate labeling for such a device which accords with such other uses to which the article is to be put." 21 CFR 801.4.

[6] "The term 'labeling' means all labels and other written, printed, or graphic matter (1) upon any article or any of its containers or wrappers, or (2) accompanying such article." Section 201(m) of the FD&C Act, 21 U.S.C. § 321(m).

[7] Regulatory definitions of the term "manufacturer" or "manufacture" appear in 21 CFR Parts 803, 806, and 807. The Medical Device Reporting regulation defines manufacturer to mean: "any person who manufactures, prepares, propagates compounds, assembles, or processes a device by chemical, physical, biological, or other procedure. The term includes any person who either: (1) Repackages or otherwise changes the container, wrapper, or labeling of a device in furtherance of the distribution of the device from the original place of manufacture; (2) Initiates specifications for devices that are manufactured by a second party for subsequent distribution by the person initiating the specifications; (3) Manufactures components or accessories that are devices that are ready to be used and are intended to be commercially distributed and intended to be used as is, or are processed by a licensed practitioner or other qualified person to meet the needs of a particular patient; or (4) Is the U.S. agent of a foreign manufacturer." 21 CFR 803.3.

FDA's regulation requiring reports of corrections and removals defines manufacturer to mean: "any person who manufactures, prepares, propagates, compounds, assembles, or processes a device by chemical, physical, biological, or other procedures. The term includes any person who: (1) Repackages or otherwise changes the container,

engaging in manufacturing functions; examples of such distributors may include owners and operators of "android market", "iTunes store", and "BlackBerry App World." A mobile medical device manufacturer may include anyone who initiates specifications, designs, labels, or creates a software system or application in whole or from multiple software components. Examples of mobile medical device manufacturers include any person or entity that:

- Creates, designs, develops, labels, re-labels, remanufactures, modifies, or creates a software system from multiple components. This could include a person or entity that creates a mobile medical app by using commercial off the shelf (COTS) software components and markets the product to perform as a mobile medical app;

- Provides mobile medical app functionality through a "web service" or "web support" for use on a mobile platform. For example, a manufacturer of a mobile medical app that allows users to access the application's medical device functionality over the web is considered a mobile medical app manufacturer;

- Initiates specifications or requirements for mobile medical apps or procures product development/manufacturing services from other individuals or entities (second party) for subsequent commercial distribution. For example, when a "developer" (i.e., an entity that provides engineering, design, and development services) creates a mobile medical app from the specifications that were initiated by the "author," the "author" who initiated and developed specifications for the mobile medical app is considered a "manufacturer" of the mobile medical app under 21 CFR 803.3. For purposes of this guidance, manufacturers of a mobile medical app would include persons or entities who are the creators of the original idea (initial specifications) for a mobile medical app, unless another entity assumes all responsibility for manufacturing and distributing the mobile medical app, in which case that other entity would be the "manufacturer."[8] Software "developers" of a mobile medical app that are only responsible for performing design and development activities to transform the author's specifications into a mobile medical app would not constitute manufacturers, and instead the author would be considered the manufacturer; or

- Creates a mobile medical app intended to be used on a mobile platform, or that manufactures a mobile app to be supported by hardware attachments to the mobile

Comment [jb11]: The proposed status of app stores will have a significant negative impact on the use of mobile apps for healthcare. App stores should be treated as unregulated online marketplaces, rather than distributors.

Comment [jb12]: Who is the manufacturer if multiple manufacturers are involved in the development of the "system"?

Comment [jb13]: How does FDA define a "web service" or "web support"? The example provided is very limited. What other activities constitute a "web service" or "web support"?

Comment [jb14]: How does this apply to an organization that develops interoperability standards? If a manufacturer designs to the specification of an interoperability standard, does the standards organization become the manufacturer?

wrapper, or labeling of a device in furtherance of the distribution of the device from the original place of manufacture to the person who makes final delivery or sale to the ultimate user or consumer; (2) Initiates specifications for devices that are manufactured by a second party for subsequent distribution by the person initiating the specifications; or (3) Manufactures components or accessories which are devices that are ready to be used and are intended to be commercially distributed and are intended to be used as is, or are processed by a licensed practitioner or other qualified person to meet the needs of a particular patient." 21 CFR 806.2 (g).

Under FDA's establishment and registration regulation, registration and listing requirements apply to anyone engaged in the manufacture, preparation, propagation, compounding, assembly, or processing of a device, activities that are defined to include: "the making by chemical, physical, biological, or other procedures of any article that meets the definition of device in section 201(h) of the act. . . . includ[ing] the following activities: (1) Repackaging or otherwise changing the container, wrapper, or labeling of any device package in furtherance of the distribution of the device from the original place of manufacture to the person who makes final delivery or sale to the ultimate consumer; (2) Initial importation of devices manufactured in foreign establishments; or (3) Initiation of specifications for devices that are manufactured by a second party for subsequent commercial distribution by the person initiating specifications." 21 CFR 807.3(d).

[8] See 21 CFR 803.3 (definition of manufacturer) & 807.20(a)(2).

platform with a device intended use.

For purposes of this guidance, a mobile platform manufacturer that commercially markets a mobile platform with an intended use (as defined in 21 CFR 801.4) of, or to be used with, a device is considered a device manufacturer under 21 CFR 803, 806 and 807. In contrast, a mobile platform manufacturer that solely distributes or markets its platform with no device intended use is considered a component[9] manufacturer and is exempt from quality systems, registration and listing requirements as described in those regulations.[10] In other words, the fact that a mobile platform could be used to run a mobile medical app identified by this guidance does not mean that the mobile platform manufacturer is considered a medical device manufacturer. For example, if it is possible to run mobile medical apps on BrandNamePhone but BrandNamePhone is not marketed by BrandNameCompany with a medical device intended use, then BrandNameCompany would not be a medical device manufacturer.

IV. Scope

This guidance explains FDA intentions to apply its regulatory requirements to a subset of mobile apps. This subset, which we are calling mobile medical apps as defined in section III, includes only those that meet the statutory definition of a device; and either:

- are used as an accessory to a regulated medical device; or
- transform a mobile platform into a regulated medical device.

This guidance does not specifically address wireless safety considerations, classification and submission requirements related to clinical decision support software, or the application of quality systems to software. The FDA intends to address these topics through separate guidance(s).

This guidance is limited only to mobile medical apps. The following examples represent mobile apps that FDA does **not** consider to be mobile medical apps for purposes of this guidance:

- Mobile apps that are electronic "copies" of medical textbooks, teaching aids or reference materials, or are solely used to provide clinicians with training or reinforce training previously received. These types of apps do not contain any patient-specific information, but could show examples for a specific medical specialty. Examples of such medical text books include the electronic Physician's Desk Reference and similar reference materials that are typically used as part of course instruction and are implemented as electronic books. Exemplary teaching aids and reference materials include: flash cards or quizzes that are used for training purposes or as reference material (e.g., with preloaded medical images, conditions, pictures, graphs, etc.); slideshows of common conditions; lists of medical terminology; and review materials that are to be used by medical students during training. (In contrast, mobile apps that allow the user to input patient-specific information along with reference material to automatically diagnose a disease or condition are considered mobile medical apps).

- Mobile apps that are solely used to log, record, track, evaluate, or make decisions or suggestions related to developing or maintaining general health and wellness. Such

[9] See 21 CFR 820.3(c).
[10] See 21 CFR 807.65(a) & 820.1(a).

Comment [jb15]: FDA should clarify how the mobile platform will be regulated particularly when multiple mobile apps are involved. If regulated, at what classification would the mobile platform be regulated?

Comment [jb16]: The principle in the sentence that begins "In contrast, a mobile platform manufacturer…" does not follow the definition of a component, which is an unfinished product that is sold to the finished device manufacturer. FDA should clarify the regulatory status of the mobile platform manufacturer.

Comment [jb17]: The example is confusing because elsewhere the agency says that a component manufacturer is technically a medical device manufacturer. Historically, FDA has exercised enforcement discretion with respect to component manufacturers, shifting the regulatory burden to the finished device manufacturer. That's not the same as saying that the component manufacturer is not a medical device manufacturer.

Comment [jb18]: FDA should expand the scope of this document to include aspects of a mHealth system that are not mobile apps.

Comment [jb19]: FDA should define the term *clinical decision support software* to clarify what is not included in this document.

Comment [jb20]: FDA should publish these guidance documents as soon as possible due to the importance for mHealth companies.

Comment [jb21]: FDA should more clearly define general health and wellness.

decisions, suggestions, or recommendations are **not** intended for curing, treating, seeking treatment for mitigating, or diagnosing a specific disease, disorder, patient state, or any specific, identifiable health condition. Examples of these apps include dietary tracking logs, appointment reminders, dietary suggestions based on a calorie counter, posture suggestions, exercise suggestions, or similar decision tools that generally relate to a healthy lifestyle and wellness.

- Mobile apps that only automate general office operations with functionalities that include billing, inventory, appointments, or insurance transactions. Examples include: apps that determine billing codes like ICD-9 (international statistical classification of diseases); medical business accounting functions and aids that track and trend billable hours, procedures, and reminders for scheduled medical appointments or blood donation appointments; apps that automate functions such as collecting patient histories that replace paper-based entry; apps that enable insurance claims data collection and processing; and other apps that are similarly administrative in nature.

- Mobile apps that are generic aids that assist users but are not commercially marketed for a specific medical indication. Examples include apps that use the mobile platform as a magnifying glass (but **not** specifically for medical purposes),[11] recording audio, note-taking, replaying audio with amplification, and other similar functionalities.

- Mobile apps that perform the functionality of an electronic health record system or personal health record system.

Comment [jb22]: FDA should define electronic health records, electronic medical records, and personal health records and definitively state how the agency intends to regulate each.

[11] Medical purpose magnifiers are classified devices and regulated either under 21 CFR 886.5840 - Magnifying spectacles ("devices that consist of spectacle frames with convex lenses intended to be worn by a patient who has impaired vision to enlarge images"), or under 21 CFR 886.5540 - Low-vision magnifiers ("a device that consists of a magnifying lens intended for use by a patient who has impaired vision. The device may be held in the hand or attached to spectacles").

V. Regulatory approach for mobile medical apps

The FDA recognizes the extensive variety of actual and potential functions of mobile apps, the rapid pace of innovation in mobile apps, and potential benefits and risks to public health. Some manufacturers of mobile medical apps have sought premarket clearance for their devices; however, many may be unsure about how the FDA regulations apply to their products.

As described in this guidance, the FDA plans to apply its regulatory oversight only to certain types of mobile apps.

This narrowly-tailored approach focuses on a subset of mobile apps that either have traditionally been considered medical devices or affect the performance or functionality of a currently regulated medical device. The FDA believes that this subset of mobile apps poses the same or similar potential risk to the public health as currently regulated devices if they fail to function as intended. Using mobile or other innovative platforms along with a mobile medical app to perform medical device functions does not necessarily change the intended use or the risk to patients if the device fails to operate properly.

Although some mobile apps that do not meet the definition of a mobile medical app may meet the FD&C Act's definition of a device, FDA intends to exercise enforcement discretion[12] towards those mobile apps. The FDA intends to monitor the performance of other[13] mobile apps that are outside this guidance and determine whether additional or different actions are necessary to protect the public health. A manufacturer may, however, at its discretion, elect to register and list, and to seek approval or clearance for these mobile apps with the FDA.

Nevertheless, the FDA strongly recommends that manufacturers of all mobile apps that may meet the definition of a device follow the Quality Systems[14] regulations (which include good manufacturing practices) in the design and development of their mobile medical apps and initiate prompt corrections to their mobile medical apps, when appropriate, to prevent patient and user harm. The FDA has found that the majority of software-related device failures are due to design errors. In one study, the most common problem was failure to validate software prior to routine maintenance.[15]

Comment [jb23]: FDA should clarify the language here and in FN13. This says that some mobile apps are subject to enforcement discretion, while others will be monitored. The way this is written, it is not clear what mobile apps are subject to enforcement discretion.

[12] This means that the FDA intends to exercise its discretion to decline to pursue enforcement actions for violations of the FD&C Act and applicable regulations by a manufacturer of a mobile medical app, as specified in this guidance. This does not constitute a change in the requirements of the FD&C Act or any applicable regulations.

[13] The FDA's review of these products indicates that the majority of these other mobile apps that may meet the definition of a medical device have functionality either to automate common medical knowledge available in the medical literature or to allow individuals to self-manage their disease or condition. Many of these mobile medical apps also automate common clinician's diagnostic and treatment tasks using simple general purpose tools, including spreadsheets, timers, or other general computer applications, by performing logging and tracking. For example, mobile medical apps that: log, track, and graph manually-entered (keyed in) data that lead to reminders or alarms; act as data viewers for patient education; organize, store, and display personal health data, such as lab results, doctor visits, dosages, calories consumed, etc.; or allow for general dose over the counter (OTC) lookups and use drug labeling to provide information that is typically available on a drug label, e.g., acetaminophen dosage for children and adults.

[14] *See* 21 CFR part 820.

[15] See Final Rule, Current Good Manufacturing Practice (CGMP); Quality System Regulation, 61 FR 52602 (October 7, 1996).

For the subset of mobile medical apps that are subject to regulatory oversight, manufacturers must meet the requirements associated with the applicable device classification. If the mobile medical app, on its own, falls within a medical device classification, its manufacturer is subject to the requirements associated with that classification. A mobile medical app, like other devices, may be classified as class I (general controls), class II (special controls in addition to general controls), or class III (premarket approval).[16]

The FDA has typically expected that the manufacturer of an accessory would meet the requirements associated with the classification of the connected device. However, this approach may not be well-suited for mobile medical apps that serve as an accessory to another medical device because of the wide variety of functions mobile medical apps can potentially perform. Therefore, FDA is seeking comment on how it should approach mobile medical apps that are accessories to other medical devices so safety and effectiveness can be reasonably assured. Mobile medical devices that are intended to be used as accessories to a regulated medical device may do so for purposes of (a) displaying, analyzing, storing, or transmitting patient-specific medical device data, or (b) controlling the operation, function, or energy source of the medical device (see Appendix A for examples).

Finally, if the mobile medical app adds medical device functionality to a mobile platform, the mobile medical app manufacturer must meet the classification requirements applicable to that functionality.

Comment [jb24]: FDA should clarify that the mobile platform manufacturer is not subject to regulation if the platform is marketed for general purposes.

A. Mobile medical apps for which FDA will apply regulatory oversight

Mobile apps may take a number of forms, but it is important to note that the FDA will apply its regulatory oversight to only the subset of mobile medical apps as expressed in this guidance.

Similarly, mobile medical apps that transform a mobile platform into a regulated medical device may do so by using attachments, display screens, sensors, or other such methods (see Appendix A for examples).

The following examples represent mobile apps FDA considers mobile medical apps and that will be subject to its regulatory oversight:

- Mobile apps that are an extension of one or more medical device(s) by connecting[17] to such device(s) for purposes of controlling the device(s) or displaying, storing, analyzing, or transmitting patient-specific medical device data. Examples of displays of patient-specific medical device data include remote display of data from bedside monitors, display of previously stored EEG waveforms, and display of medical images directly from a Picture Archiving and Communication System (PACS) server, or similar display functions that meet the definition of an MDDS. Examples of mobile apps that control medical devices include apps that provide the ability to control inflation and deflation of a blood pressure cuff through a mobile platform and mobile apps that control the delivery of insulin on an insulin pump by transmitting control signals to the pumps from the mobile platform.

[16] *See* fns. 3 and 4.
[17] To meet this criterion, the mobile medical apps need not be physically connected to the regulated medical device.

- Mobile apps that transform the mobile platform into a medical device by using attachments, display screens, or sensors or by including functionalities similar to those of currently regulated medical devices. Examples include a mobile app that uses a mobile platform for medical device functions, such as attachment of a transducer to a mobile platform to function as a stethoscope, attachment of a blood glucose strip reader to a mobile platform to function as a glucose meter, or attachment of electrocardiograph (ECG) electrodes to a mobile platform to measure, store, and display ECG signals; or, a mobile app that uses the built-in accelerometer on a mobile platform to collect motion information for monitoring sleep apnea.

- Mobile apps that allow the user to input patient-specific information and - using formulae or processing algorithms - output a patient-specific result, diagnosis, or treatment recommendation to be used in clinical practice or to assist in making clinical decisions. Examples include mobile apps that provide a questionnaire for collecting patient-specific lab results and compute the prognosis of a particular condition or disease, perform calculations that result in an index or score, calculate dosage for a specific medication or radiation treatment, or provide recommendations that aid a clinician in making a diagnosis or selecting a specific treatment for a patient.

To further clarify, the following categories identify the types of mobile medical apps and their associated classifications.

- **Displaying, storing or transmitting patient-specific medical device data in its original format –** Mobile medical apps with this functionality constitute an MDDS (21 CFR 880.6310) and are subject to class I requirements (general controls), which include adequate design controls, registration, device listing, adverse event reporting, and corrections and removals. The FDA believes that requiring general controls sufficiently manage the risks for mobile medical apps that are used as a secondary display to a regulated medical device and are not intended for providing primary diagnosis or treatment decisions (i.e. mobile medical apps that meet the MDDS definition).
- **Controlling the intended use, function, modes, or energy source of the connected medical device -** Mobile medical apps of this type are considered an accessory to the connected device and are required to comply with the controls applicable to that connected device. The FDA considers such a mobile medical app to extend the use and functionality of the connected medical device. As a result, the mobile medical app would be required to comply with the regulations applicable to the connected medical device in order to address any associated risks.
- **Transforming or making the mobile platform into a regulated medical device** – Mobile medical devices that use attachments, display screens, sensors or other such similar components to transform a mobile platform into a regulated medial device are required to comply with the device classification associated with the transformed platform. For example, a mobile medical app that uses sensors (internal or external) on a mobile platform for electronic stethoscope functions is considered to convert the mobile platform into an electronic stethoscope; manufacturers of such a mobile medical app are required to follow the requirements of 21 CFR 870.1875(b) (Electronic Stethoscope). Similarly, a mobile medical app that displays radiological images for diagnosis transforms the mobile platform into a class II PACS under 21 CFR 892.2050. The FDA has already cleared such mobile medical apps.

Comment [jb25]: Again, FDA should clarify the regulatory status of the mobile platform in these examples.

Comment [jb26]: This example describes clinical decision support software. We recommend that FDA delete this example to prevent confusion.

Comment [jb27]: This language is concerning from the mobile platform manufacturer's perspective. Again, FDA should clarify that the mobile app doesn't transform the mobile platform into an electronic stethoscope but that the mobile app is considered an electronic stethoscope.

- **Creating alarms, recommendations or creating new information (data) by analyzing or interpreting medical device data** – Mobile medical apps of this type that analyze or interpret data (electronically collected or manually entered) from another medical device are considered an accessory to that medical device. These mobile medical apps are generally required to comply with the device classification associated with that other medical device. These types of systems have been previously classified under the same regulations as the connected device; specifically, the decision support tool is treated as an accessory and subject to the same regulatory requirements as the connected device as determined by the connected device's classification. For example, software that analyzes blood glucose readings to help manage diabetes has been classified as part of a "Glucose Test System" under 21 CFR 862.1345. The FDA has cleared several mobile medical apps with attachments to a mobile platform. Examples include patient monitoring mobile apps that are classified as cardiac monitoring software under 21 CFR 870.2300 (Cardiac monitor). Other mobile medical apps that use a hardware attachment or interface to a monitoring system that have been cleared include an automatic electronic blood pressure monitor (21 CFR 870.1130) and a perinatal monitoring system (21 CFR 884.2740).

The FDA plans to address in a separate issuance mobile medical apps intended to analyze, process, or interpret medical device data (electronically collected or manually entered) from more than one medical device. The implications of these analyses and interpretations may pose a wide range of risks to public health and patient safety. Requiring such mobile medical apps to comply with the same requirements as their connected devices may not be appropriate in some cases. For example, analysis of class I device information along with other demographic information can result in an interpretation of a highly acute patient condition, which presents a greater risk than the connected class I device. On the other hand, an analysis or interpretation of data from class II or class III devices can lead to a simple informational result, with minimal implications or risks to public health and patient safety—in other words, a level of risk more characteristic of a class I device. The FDA has previously classified software that calculates a drug dose based on a patients height, weight, mass, and other patient-specific information as a "Drug Dose Calculator" under 21 CFR 868.1890. The FDA encourages manufacturers of such mobile medical apps to contact the Agency to determine the classification of their mobile app. In addition, the FDA seeks public comment on whether and how it can provide greater clarity for these types of mobile medical apps.

Comment [jb28]: FDA should publish this other guidance as soon as possible.

Comment [jb29]: FDA should clarify by what means (i.e., 513(g)) manufacturers should contact the Agency for this feedback.

VI. Regulatory requirements

This guidance, including the Appendix A and existing medical device regulatory classifications in Appendix B, is intended to assist manufacturers in determining if a product is a mobile medical app and FDA's expectations for that product. Additional information can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/default.htm. This section describes in greater detail the regulatory requirements applicable to mobile medical apps under this guidance (as described in Section V).

A. Requirements for mobile medical device manufacturers subject to regulatory oversight

Manufacturers of mobile medical devices are subject to the requirements described in the applicable device classification regulations. Depending on the classification and the associated regulation for the mobile medical device, manufacturers of mobile medical devices are required to follow associated controls established by the regulation.

Class I devices: General Controls, including:

- Establishment registration, and Medical Device listing (21 CFR Part 807);
- Quality System (QS) regulation (21 CFR Part 820);
- Labeling requirements (21 CFR Part 801);
- Medical Device Reporting (21CFR Part 803);
- Premarket notification (21CFR Part 807);
- Reporting Corrections and Removals (21 CFR Part 806); and
- Investigational Device Exemption (IDE) requirements for clinical studies of investigational devices (21 CFR Part 812)

Class II devices: General Controls, Special Controls, and (for most Class II devices) Premarket Notification

Class III devices: General Controls and Premarket Approval (21 CFR Part 814)

Appendix C provides a brief summary of the above requirements. Additional information is available at http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/default.htm, under "Overview of Medical Device Regulation" and "How to Market Your Device." If you need further assistance, you may contact the Division of Small Manufacturers, International and Consumer Assistance: Email: dsmica@fda.hhs.gov; phone: 301-796-7100 or 800-638-2041.

B. Expectations for mobile medical app distributors

The FDA expects distributors of mobile medical apps who may or may not be a platform or service provider will cooperate with manufacturers in conducting corrections and removal actions. Mobile medical app manufacturers are required to make timely reports of corrections

Comment [jb30]: FDA should clarify what it means by "expects distributors" to "cooperate" and should provide the legal basis for any such expectation/requirement.

and removals made to reduce a health risk or remedy a violation of the FD&C Act that presents a health risk, and to keep records regarding other corrections and removals.[18]

[18] 21 CFR 806.10 and 806.20.

APPENDIX A – Examples of mobile medical apps

This Appendix provides an exemplary list of functionalities to illustrate types of mobile medical apps. The FDA understands that there may be other unique and innovative mobile apps that may not be covered in this list that may also constitute mobile medical apps. This list is not exhaustive; it is only intended to provide clarity and assistance in identifying mobile medical apps.

Mobile medical apps that are extensions of regulated medical device for purposes of controlling the medical device or for the purpose of displaying, storing, analyzing, or transmitting patient- specific medical device data:

- Apps that allow the user to view medical images on a mobile platform and perform an analysis or process for diagnosis;
- Apps that connect to DICOM medical image servers and provide processing functions such as pan, zoom, measurement, auto contrasting, automatic detection of features, and other similar functionality;
- Apps that analyze, assess, or interpret electrocardiogram or electroencephalogram data;
- Apps that connect the mobile platform to vital signs monitors, bedside monitors, cardiac monitors, or other similar devices to:
    - Be used as a central viewing station for display;
    - Remotely access vital sign measurements of patients at home;
    - Be used in displaying and viewing digital images, including digital mammography, for review and analysis by trained medical practitioners;
    - Record arterial oxygen saturation and pulse rate of adult and pediatric patients inside hospitals and activate an alarm based on changes in levels;
    - Remotely review other standard or critical real-time numeric data from labor and delivery;
    - Perform remote Holter monitoring;
    - Connect to medical imaging devices for displaying, processing or storing medical images;
    - Wirelessly connect to medical devices and can relay or generate alarms;
    - Perform remote control, setting changes, or readout via wireless links such as programming or controlling a hearing aid system or implantable or body worn medical device.
- Apps that are used as patient screening tools for blood transfusion (extension of Blood Establishment Computer Software (BECS)) or other biologics;
- Apps that connect to a home use diagnostic medical device such as a blood pressure meter, body composition analyzer, or blood glucose meter to collect historical data or to receive, transmit, store, analyze, and display measurements from connected devices;
- Apps that control a blood-pressure cuff connected to a mobile platform to inflate the cuff and measure a person's blood pressure; or
- Apps that act as wireless remote controls or synchronization devices for MRI or X-Ray machines.

Mobile medical apps that transform or make the mobile platform into a regulated medical

device by using attachments or sensors or similar medical device functions:

- Apps that attach EKG/ECG leads to a mobile platform to collect/analyze/monitor EKG/ECG signals;
- Apps that connect wirelessly to a blood glucose tester to display, calculate, trend, convert, or download results to a PDA;
- Apps that generate sine signals from 125Hz to 8kHz (8 steps) to check the user's hearing;
- Apps that act as a blood glucose meter by using an attachment to a mobile platform;
- Apps that act as an electronic stethoscope by connecting (either via wire or wirelessly) to an external sensor to record, manipulate, or measure sound waves;
- Apps that use the mobile platform with or without a sound transducer (microphone) to act as an electronic stethoscope to amplify heart, lung, blood vessel, enteral, and other body sounds;
- Apps that use the built-in accelerometer or other similar sensors in a mobile platform to monitor the user's movement to determine conditions such as sleep apnea, sleep phase, fall detection, or detect motion related to other conditions or diseases or to measure heart rate;
- Apps that use the light source from a mobile platform to cure and treat specific conditions, such as acne;
- Apps that attach sensors to a mobile platform to measure blood glucose, electrocardiograph, or other similar functions;
- Apps that use a mobile platform's built in features such as light, vibrations, camera, or other similar sources to perform medical functions;
- Apps that use a mobile platform to upload electroencephalograph (EEG) recordings and automatically detect seizures;
- Apps that use a mobile platform to record response time and accuracy of patients completing a cognitive task and/or automatically score or interpret cognitive testing results;
- Apps that use pictures and sound to diagnose conditions by comparing to previously determined diagnoses of images, symptoms, sounds, or other physiological measurements; or
- Apps that use a mobile platform in determining blood donor eligibility prior to collection of blood or blood components.

Mobile medical apps that allow the user to input patient-specific information and - *using formulae or a processing algorithm* - output a *patient-specific* result, diagnosis, or treatment recommendation that is used in clinical practice or to assist in making clinical decisions:

- Apps that perform calculations intended to be used by clinicians for automating tasks, such as:
  - eGFR with CKD-Epi, Cockcroft-Gault, and MDRD;
  - A-a gradient, etc.
- Apps that act as calculators or utilize algorithms to produce an index, score, scale, or other similar calculations (e.g., Glasgow Coma Scale, pain index, Apgar score, NIH stroke scale, etc.);
- Apps that calculate parameters associated with the use of radioisotopes;
- Apps that calculate the amount of chemotherapy needed based on the patient's Body Surface Area;

- Apps that assist with patient-specific dosing, e.g., radiation planning;
- Apps that calculate Warfarin Loading and Warfarin Maintenance doses for different anti- coagulation therapies based on nomograms;
- Apps that act as calculators to determine the maximum dosage of local anesthesia based on a patient's weight and age; or
- Apps that calculate Osteoporosis Risk Assessment by Composite Linear Estimate (ORACLE score).
- Apps that collect blood glucose readings and caloric intake to help manage diabetes by calculating pre-meal insulin dose (Bolus) or Basal adjustments; or
- Apps that act as a dosing calculators for a treatment regimen intended for a specific patient population (pediatrics);
- Apps that define disease stage or progression, and provide a prognosis of a medical condition or predict a patient's response to treatment based on a analysis of physiological, laboratory, and other data; or
- Apps that provide differential diagnosis tools for a clinician to systematically compare and contrast clinical findings (symptoms/ results, etc.) to arrive at possible diagnosis for a patient.

Comment [jb31]: These examples should be removed to avoid confusion since these should be considered with CDS software.

APPENDIX B – Examples of current regulations

This appendix provides examples of currently regulated devices, the Class according to which they are regulated, and their regulation numbers. This list is not a complete list of products and is intended only to provide clarity and assistance in identification of applicable regulations. FDA encourages mobile medical app manufacturers to search FDA's public databases, such as the medical device database for premarket cleared (510(k)) devices and product classification database, to determine the level of regulation for a given device. The databases can be accessed through the following link: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Databases/default.htm.

For more detailed list and a searchable database of medical device classifications, please visit: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD/classification.cfm.

Additional information can also be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/default.htm.

Regulation number	Medical Device	Device Class	Submission Type ID
876.1500(b)(2)	Accessories, Photographic, For Endoscope (Exclude Light Sources)	1	510(k) exempt
870.2770	Analyzer, Body Composition	2	510(k)
868.1890	Calculator, Drug Dose	2	510(k)
868.1890	Calculator, Predicted Values, Pulmonary Function	2	510(k)
868.1880	Calculator, Pulmonary Function Data	2	510(k)
868.1900	Calculator, Pulmonary Function Interpretation (Diagnostic)	2	510(k)
862.2100	Calculator/Data Processing Module, For Clinical Use	1	510(k) exempt
874.3310	Calibrator, Hearing Aid / Earphone And Analysis Systems	2	510(k)
878.4160	Camera, Cine, Microsurgical, With Audio	1	510(k) exempt
878.4160	Camera, Still, Microsurgical	1	510(k) exempt
878.4160	Camera, Television, Endoscopic, With Audio	1	510(k) exempt
870.1110	Computer, Blood-Pressure	2	510(k)
870.1425	Computer, Diagnostic, Programmable	2	510(k)
892.2020	Device, Communications, Images, Ophthalmic	1	510(k) exempt
892.2010	Device, Digital Image Storage, Radiological	1	510(k) exempt
892.2010	Device, Storage, Images, Ophthalmic	1	510(k) exempt
876.1500	Device, Telemedicine, Robotic	2	510(k)
862.2100	Digital Image, Storage And Communications, Non-Diagnostic, Laboratory Information System	1	510(k) exempt
892.2030	Digitizer, Image, Radiological	2	510(k)
892.2030	Digitizer, Images, Ophthalmic	2	510(k)
870.2800	Electrocardiograph, Ambulatory, With Analysis Algorithm	2	510(k)
882.1400	Electroencephalograph - Automatic Event Detection Software For Full-Montage Electroencephalograph	2	510(k)
882.1400	Electroencephalograph - Burst Suppression Detection Software For Electroencephalograph	2	510(k)

882.1400	Electroencephalograph - Index-Generating Electroencephalograph Software	2	510(k)
882.1400	Electroencephalograph - Non-Normalizing Quantitative Electroencephalograph Software	2	510(k)
882.1400	Electroencephalograph - Normalizing Quantitative Electroencephalograph Software	2	510(k)
882.1400	Electroencephalograph - Source Localization Software For Electroencephalograph Or Magnetoencephalograph	2	510(k)
876.1500	Endoscopic Video Imaging System/Component, Gastroenterology Urology	2	510(k)
884.2225	Imager, Ultrasonic Obstetric-Gynecologic	2	510(k)
876.1500	Led Light Source	2	510(k)
878.4810	Light Based Over The Counter Wrinkle Reduction	2	510(k)
878.4810	Light Based Over-The-Counter Hair Removal	2	510(k)
880.6350	Light, Examination, Medical, Battery Powered	1	510(k) exempt
880.5580	Locator, Acupuncture Point	2	510(k)
870.1875(b)	Lung Sound Monitor	2	510(k)
886.5540	Magnifier, Hand-Held, Low-Vision	1	510(k) exempt
880.6315	Medication Management System, Remote	2	510(k)
884.6190	Microscope And Microscope Accessories, Reproduction, Assisted	1	510(k) exempt
868.2377	Monitor, Apnea, Home Use	2	510(k)
880.2400	Monitor, Bed Patient	1	510(k) exempt
884.2660	Monitor, Blood-Flow, Ultrasonic	2	510(k)
868.2375	Monitor, Breathing Frequency	2	510(k)
870.2300	Monitor, Cardiac (Incl. Cardiotachometer & Rate Alarm)	2	510(k)
886.1510	Monitor, Eye Movement, Diagnostic	2	510(k)
884.2660	Monitor, Fetal Doppler Ultrasound	2	510(k)
884.2730	Monitor, Heart Rate, Fetal, Non-Stress Test (Home Use)	2	510(k)
884.2660	Monitor, Heart Rate, Fetal, Ultrasonic	2	510(k)
884.2660	Monitor, Hemic Sound, Ultrasonic	2	510(k)
884.2640	Monitor, Phonocardiographic, Fetal	2	510(k)
870.2300	Monitor, Physiological, Patient(Without Arrhythmia Detection Or Alarms)	2	510(k)
870.2340	Monitor, St Segment	2	510(k)
884.2660	Monitor, Ultrasonic, Fetal	2	510(k)
884.2720	Monitor, Uterine Contraction, External (For Use In Clinic)	2	510(k)
878.4810	Over-The-Counter Powered Light Based Laser For Acne	2	510(k)
868.2550	Pneumotachometer	2	510(k)
878.4810	Powered Light Based Non-Laser Surgical Instrument	2	510(k)
870.2800	Recorder, Event, Implantable Cardiac,(Without Arrhythmia Detection)	2	510(k)
876.1725	Recorder, External, Pressure, Amplifier & Transducer	2	510(k)
890.5050	Reminder, Medication	1	510(k) exempt
880.2700	Scale, Stand-On, Patient	1	510(k) exempt
864.9175	Software, Blood Bank, Stand Alone Products	2	510(k)
886.5540	Spectacle Microscope, Low-Vision	1	510(k) exempt
868.1850	Spirometer, Monitoring (W/Wo Alarm)	2	510(k)
870.1875(b)	Stethoscope, Electronic	2	510(k)

868.1920	Stethoscope, Esophageal, With Electrical Conductors	2	510(k)
884.2900	Stethoscope, Fetal	1	510(k) exempt
876.4300	System, Alarm, Electrosurgical	2	510(k)
884.2990	System, Documentation, Breast Lesion	2	510(k)
892.2050	System, Image Processing, Radiological	2	510(k)
892.1560	System, Imaging, Optical Coherence Tomography (Oct)	2	510(k)
884.2800	System, Monitoring, For Progress Of Labor	2	510(k)
884.2740	System, Monitoring, Perinatal	2	510(k)
870.2300	System, Network And Communication, Physiological Monitors	2	510(k)
876.1500	System, Surgical, Computer Controlled Instrument	2	510(k)
864.9175	System, Test, Automated Blood Grouping And Antibody	2	510(k)
880.2910	Thermometer, Electronic, Clinical	2	510(k)
886.1930	Tonometer, Ac-Powered	2	510(k)
870.2920	Transmitters And Receivers, Electrocardiograph, Telephone	2	510(k)
870.2910	Transmitters And Receivers, Physiological Signal, Radiofrequency	2	510(k)

APPENDIX C – Brief description of regulatory requirements

Comment [jb32]: FDA should clarify which of these requirements are applicable (if any) to mobile platform manufacturers and in what situation those regulations apply.

This Appendix provides a high level description of some select regulatory requirements for medical devices, including mobile medical apps. The FDA has additional resources and publications online that describes the requirements in detail.

1. Establishment Registration and Medical Device Listing

Under 21 CFR Part 807, manufacturers of medical devices are required to annually register their establishments[19] with FDA and provide a list of the devices they market. The registration and listing requirement is a means of keeping FDA advised of who is manufacturing devices, and of the types of devices an establishment is manufacturing. Mobile medical app manufacturers are required to register their establishments with FDA and to list[20] by identifying to FDA the mobile medical apps they are marketing.

Additional information can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/RegistrationandListing/default.htm. If you need further assistance, you may contact the Division of Risk Management Operations, Regulatory Policy and Systems Branch: Email: reglist@fda.hhs.gov, phone: 301-796-7400. Assistance is also available from, Division of Small Manufacturers, International and Consumer Assistance: Email: dsmica@fda.hhs.gov phone: 301-796-7100 or 800-638-2041

2. Investigational Device Exemption (IDE) requirements

An IDE allows an investigational device to be used in a clinical study in order to collect safety and effectiveness data required to support a Premarket Approval (PMA) application or a Premarket Notification 510(k) submission to FDA. Clinical studies with devices of significant risk must be approved by FDA and by an Institutional Review Board (IRB) before the study can begin. Studies with devices of non-significant risk must be approved by the IRB only before the study can begin.

Mobile medical app manufacturers who are creating mobile apps with novel technologies are encouraged to engage in early collaboration meetings with the FDA to receive clear direction for testing and development of those devices requiring clinical investigations to support marketing.

Additional information about these meetings is described in guidance issued on February 28, 2001: "Early Collaboration Meetings Under the FDA Modernization Act (FDAMA); Final Guidance for Industry and for CDRH Staff." This document is available at http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073604.htm.

[19] Under 21 CFR 807.3(c), "*Establishment*" is defined as "a place of business under one management at one general physical location at which a device is manufactured, assembled, or otherwise processed."
[20] *See* 21 CFR part 807.

Further information regarding the investigational device exemption can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/InvestigationalDeviceExemptionIDE/default.htm.

3. Labeling requirements

Medical device manufacturers are required to comply with applicable labeling regulations found in 21 CFR Part 801, and Part 809 for radiological health products.

4. Premarket submission for approval or clearance

Mobile medical app manufacturers should identify the current classification covering their mobile medical app. Manufacturers are required to prepare and submit to the FDA an appropriate premarket submission, as required for their device classification.

Additional information can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/RegistrationandListing/default.htm.

5. Quality System Regulation (QSR)

Mobile medical app manufacturers are required to comply with the QSR. The QSR does not prescribe in detail how a manufacturer must produce a specific device, but provides a framework for all manufacturers to develop and follow to help ensure that their products consistently meet applicable requirements and specifications. As part of this framework, mobile medical app manufacturers are required to develop requirements for their products that will result in devices that are safe and effective, and to establish methods and procedures to design, produce, and distribute their devices.

Furthermore, mobile medical app manufacturers are required, as part of the QSR (21 CFR 820.30), to appropriately verify and validate their mobile medical apps along with the mobile platform to ensure safe and effective operation of the mobile medical app.

Mobile medical app manufacturers are required to ensure that adequate controls and processes are in place through purchasing controls to ensure safe distribution, installation and operation of the mobile medical app.

Additional information regarding the QS regulation and can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/QualitySystemsRegulations/default.htm.

6. Medical Device Reporting (MDR) (Adverse event reporting)

The Medical Device Reporting (MDR) regulation requires manufacturers and importers of medical devices to submit reports to the FDA whenever they receive or otherwise become aware of information, from any source, that reasonably suggests that a device they market may have caused or contributed to a death or serious injury, or has malfunctioned and the device or similar device that they market would be likely to cause or contribute to a

Comment [jb33]: FDA should clarify who is responsible for adverse event reporting in an mHealth system where multiple manufacturers may be involved.

reportable death or serious injury if the malfunction were to recur.[21] MDR requires medical device manufacturers to:

- Submit MDR reportable events involving their medical devices as described in 21 CFR Parts 803.10(c) and 803.50;
- Submit 5-day reports as described in 21 CFR Part 803.53;
- Submit supplemental reports as described in 21 CFR Part 803.56;
- Develop, maintain, and implement written procedures for the identification and evaluation of all medical device events to determine whether the event is MDR reportable as described in 21 CFR Part 803.17;
- Conduct an investigation of each event and evaluate the cause of the event as described in 21 CFR Part 803.50(b)(3); and
- Establish and maintain complete files for all complaints concerning adverse medical device events as described in 21 CFR Part 803.18.

The MDR report (FDA Form 3500A) must contain all the information described in 21 CFR Part 803.52 that is reasonably known to the manufacturer. Information reasonably known includes any information that:

- Can be obtained by contacting a user facility, importer, or other initial reporter;
- Is in the possession of the manufacturer; or
- Can be obtained by analysis, testing, or other evaluation of the device.

For additional instructions on how to complete the 3500A form, refer to the document titled Instructions for Completing Form FDA 3500A" at:
http://www.fda.gov/Safety/MedWatch/HowToReport/DownloadForms/ucm149238.htm

For additional guidance on the MDR regulation and the reporting requirements, refer to the document titled "Medical Device Reporting for Manufacturers" at:
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm094529.htm.

[21] See 21 CFR part 803.

For Questions about Medical Device Reporting, including interpretation of MDR policy:

- Call: (301) 796-6670 (voice)
- Email: RSMB@fda.hhs.gov
- Or write to:
  - Food and Drug Administration
    Center for Devices and Radiological Health
    Reporting Systems Monitoring Branch
    10903 New Hampshire Avenue
    WO Bldg. 66, Room 3217
    Silver Spring, MD 20993-0002

7. Correcting Problems

Comment [jb34]: FDA should clarify the roles and responsibilities of manufacturers of devices in mHealth. In particular, FDA should clarify who is responsible for reporting a failure in an mHealth system that contains multiple medical devices from various manufacturers?

A mobile medical app manufacturer may voluntarily take action at any time or may be requested to take action by the FDA to correct problems. Voluntary action is usually taken by device manufacturers. Examples of the types of actions that a mobile medical app manufacturer may be requested to take include, but are not limited to:

- Inspecting the device for problems;
- Repairing the device;
- Adjusting settings on the device; and
- Upgrading software to reduce risk from a "bug" or unintended response.

Under certain circumstances, FDA may initiate a request that a manufacturer address a problem with a device through other means, including by removal of the product from the market. When recommending corrective action, the FDA intends to take into account the essential role that certain mobile medical apps take as an integral part of a larger patient care system.

Reporting Corrections to FDA:

In accordance with 21 CFR 806.10, mobile medical app manufacturers are required to promptly report, within 10 working days from the time the correction is initiated, to the FDA certain actions concerning device corrections and removals for the mobile medical app. Specifically, mobile medical app manufacturers are required to report to FDA any corrections made to a mobile medical app to reduce a risk to health posed by the mobile medical app or to remedy a violation of the FD&C Act caused by the mobile medical app which may present a risk to health.

The reporting requirement does not extend to all modifications to mobile medical apps. For example, mobile medical app manufacturers are exempt from reporting requirements under 21 CFR 806.1(b)[22] for certain actions that would improve the quality of a mobile medical app

[22] Under 21 CFR § 806.1(b), the following actions are exempt from the reporting requirements of part 806:
(1) Actions taken by device manufacturers or importers to improve the performance or quality of a device but that do not reduce a risk to health posed by the device or remedy a violation of the act caused by the device.
(2) Market withdrawals as defined in § 806.2(h).
(3) Routine servicing as defined in § 806.2(k).

but that would not reduce a risk to health posed by the mobile medical app or remedy a violation of the FD&C Act. If there is not a "risk to health" involved, a report to FDA is not required, but the mobile medical app manufacturer must keep a record of the correction.

More information about reporting requirements under 21 CFR Part 806 is available at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/RecallsCorrectionsAndRemovals.

For additional general information about medical device recalls, visit: http://www.fda.gov/MedicalDevices/Safety/RecallsCorrectionsRemovals/default.htm.

(4) Stock recoveries as defined in § 806.2(l).

APPENDIX D – Additional Resources

1. Guidance for Industry and FDA Staff - Implementation of Medical Device Establishment Registration and Device Listing Requirements Established by the Food and Drug Administration Amendments Act of 2007 -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm185871.htm
2. Medical Device Reporting for Manufacturers -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm094529.htm
3. Guidance for the Submission of Premarket Notifications for Medical Image Management Devices -- (http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073721.pdf)
4. Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm089543.htm
5. Devices; Current Good Manufacturing Practice (CGMP) Final Rule; Quality System Regulation" (61 FR 52602--52662). The Quality System regulation (Title 21 Code of Federal Regulations Part 820)
6. Design Control Guidance For Medical Device Manufacturers -- http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM070642.pdf
7. General Principles of Software Validation; Final Guidance for Industry and FDA Staff -- http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM085371.pdf
8. Guidance for Industry - Cybersecurity for Networked Medical Devices Containing Off-the- Shelf (OTS) Software -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm077812.htm
9. Information for Healthcare Organizations about FDA's "Guidance for Industry: Cybersecurity for Networked Medical Devices Containing Off-The-Shelf (OTS) Software" -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm070634.htm
10. IEC 60601-1-4:1996, *Medical electrical equipment, Part 1: General requirements for safety, 4. Collateral Standard: Programmable electrical medical systems*. International Electrotechnical Commission, 1996.
11. IEC 62304:2006, *Medical device Software – Software life cycle processes*. International Electrotechnical Commission, 2006.
12. IEC 61508:1998, *Functional safety of electrical/electronic/programmable electronic safety- related systems.* International Electrotechnical Commission, 1998.
13. IEEE Std 1012-1986, *Software Verification and Validation Plans*, Institute for Electrical and Electronics Engineers, 1986.
14. *IEEE Standards Collection, Software Engineering*, Institute of Electrical and Electronics Engineers, Inc., 1994. ISBN 1-55937-442-X.

15. ISO 8402:1994, *Quality management and quality assurance - Vocabulary*. International Organization for Standardization, 1994.
16. ISO 9000-3:1997, *Quality management and quality assurance standards - Part 3: Guidelines for the application of ISO 9001:1994 to the development, supply, installation and maintenance of computer software*. International Organization for Standardization, 1997.
17. ISO 9001:1994, *Quality systems - Model for quality assurance in design, development, production, installation, and servicing.* International Organization for Standardization, 1994.
18. ISO 13485:1996, *Quality systems - Medical devices - Particular requirements for the application of ISO 9001.* International Organization for Standardization, 1996.
19. ISO/IEC 12119:1994, *Information technology - Software packages - Quality requirements and testing*, Joint Technical Committee ISO/IEC JTC 1, International Organization for Standardization and International Electrotechnical Commission, 1994.
20. ISO/IEC 12207:1995, *Information technology - Software life cycle processes*, Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 7, International Organization for Standardization and International Electrotechnical Commission, 1995.
21. ISO/IEC 14598:1999, *Information technology - Software product evaluation*, Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 7, International Organization for Standardization and International Electrotechnical Commission, 1999.
22. ISO 14971-1:1998, Medical Devices - Risk Management - Part 1: Application of Risk Analysis. International Organization for Standardization, 1998.
23. The draft guidance "Radio-Frequency Wireless Technology in Medical Devices". http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm077210.htm

Attachment B:
MRC’s Proposed Changes to FDA’s Draft Guidance

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Guidance for Industry and Food and Drug Administration Staff

Mobile Medical Applications

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This guidance document is being distributed for comment purposes only.

Document issued on: [INSERT FINAL DATE]

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For questions regarding this document, contact Bakul Patel at 301-796-5528 or by electronic mail at Bakul.Patel@fda.hhs.gov . For questions regarding this document concerning devices regulated by CBER, contact the Office of Communication, Outreach and Development (OCOD), by calling 1-800-835-4709 or 301-827-1800.

Deleted: You should submit comments and suggestions regarding this draft document within **90** days of publication in the *Federal Register* of the notice announcing the availability of the draft guidance. Submit written comments to the Division of Dockets Management (HFA-305), Food and Drug Administration, 5630 Fishers Lane, rm. 1061, Rockville, MD 20852. Submit electronic comments to http://www.regulations.gov. Identify all comments with the docket number listed in the notice of availability that publishes in the *Federal Register*.¶
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U.S. Department of Health and Human Services
Food and Drug Administration

Center for Devices and Radiological Health

Center for Biologics Evaluation and Research

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Preface

Additional Copies

CDRH

Additional copies are available from the Internet. You may also send an e-mail request to dsmica@fda.hhs.govto receive an electronic copy of the guidance or send a fax request to 301-827-8149 to receive a hard copy. Please use the document number (1741) to identify the guidance you are requesting.

CBER

Additional copies of this draft guidance are available from the Office of Communication, Outreach and Development (OCOD) (HFM-40), 1401 Rockville Pike, Suite 200N, Rockville, MD 20852-1448, or by calling 1-800-835-4709 or 301-827-1800, or from the Internet at http://www.fda.gov/BiologicsBloodVaccines/GuidanceComplianceRegulatoryInformation/Guidances/ default.htm

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Guidance for Industry and Food and Drug Administration Staff

Mobile Medical Applications

This guidance represents the Food and Drug Administration's (FDA's) current thinking on this topic. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. You can use an alternative approach if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative approach, contact the FDA staff responsible for implementing this guidance. If you cannot identify the appropriate FDA staff, call the appropriate number listed on the title page of this guidance.

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I. Introduction

The Food and Drug Administration (FDA) is issuing this guidance document to inform manufacturers, distributors, and other entities about how the FDA intends to apply its regulatory authorities to select software applications intended for use on mobile platforms (mobile applications or "mobile apps").

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Given the rapid expansion and broad applicability of mobile apps, the FDA is issuing this guidance document to clarify the types of mobile apps to which the FDA intends to apply its authority. At this time, the FDA intends to apply its regulatory requirements solely to a subset of mobile apps.

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FDA's guidance documents, including this guidance, do not establish legally enforceable responsibilities. Instead, guidances describe the Agency's current thinking on a topic and should be viewed only as recommendations, unless specific regulatory or statutory requirements are cited. The use of the word "should" in Agency guidances means that something is suggested or recommended, but not required.

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II. Background

A growing number of software applications are being developed for use on mobile platforms, which include smart phones, tablet computers, and personal digital assistants. As these mobile platforms become more user friendly, computationally powerful, and readily available, innovators have begun to develop mobile apps of increasing complexity to leverage the portability mobile platforms can offer. Some of these new mobile apps are specifically targeted to assisting individuals in their own health and wellness management. Other mobile apps are targeted to healthcare providers as tools to improve and facilitate the delivery of patient care.

In 1989, FDA prepared a general policy statement on how it planned to determine whether a computer-based product and/or software-based product is a device, and, if so, how the FDA intended to regulate it. The document, "FDA Policy for the Regulation of Computer Products," became known as the "Draft Software Policy." After 1989, however, the use of computer and software products as medical devices grew exponentially and the types of products diversified and grew more complex (and that trend has continued). As a result, the FDA determined that it would be impractical to prepare an overarching software policy to address all of the issues related to the regulation of all medical devices containing software. Therefore, the Draft Software Policy was withdrawn.[1]

Although the FDA has not issued an overarching software policy, the Agency has formally classified certain types of software applications that meet the definition of a device and, through classification, identified specific regulatory requirements that apply to these devices and their manufacturers. These software devices include products that feature one or more software components, parts, or accessories (such as electrocardiographic (ECG) systems used to monitor patient activity), as well as devices that are composed solely of software (such as laboratory information management systems). On February 15, 2011, the FDA issued a regulation down-classifying certain computer- or software-based devices intended to be used for the electronic transfer, storage, display, and/or format conversion of medical device data—called Medical Device Data Systems (MDDSs)—from Class III (high-risk) to Class I (low-risk).[2]

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Moreover, the FDA has previously clarified that when standalone software is used to analyze medical device data, it has traditionally been regulated as an accessory to a medical device[3] or as medical device software.

[1] 70 FR 824 at 890 (January 5, 2005) Federal Register Notice [Docket No 1998N-0046], http://edocket.access.gpo.gov/2005/pdf/05-155.pdf.

[2] 76 FR 8637 (Feb. 15, 2011), Final Rule.

[3] See, for example, Content of a 510(k) -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/PremarketSubmissions/PremarketNotification510k/ucm142651.htm) ("Accessories to classified devices take on the same classification as the "parent" device. An accessory such as software that accepts input from multiple devices usually takes on the classification of the "parent" device with the highest risk, i.e., class."); Final Rule, Medical Devices, Medical Device Data Systems, 76 Fed. Reg. 8637, 8643-8644 (Feb. 15, 2011).

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As is the case with traditional medical devices, mobile medical apps can pose potential risks to public health. Moreover, mobile medical apps may pose additional or different risks due to the unique characteristics of the platform. For example, the interpretation of radiological images on a mobile device could be adversely affected by the smaller screen size, lower contrast ratio, and uncontrolled ambient light of the mobile platform; FDA intends to take these limitations into account in assessing the appropriate regulatory oversight for these products.

This guidance clarifies and outlines the FDA's current thinking. The Agency will continue to evaluate the potential impact these technologies might have on improving health care, reducing potential medical mistakes, and protecting patients.

III. Definitions

In addition to the terms defined here, the Glossary (Appendix G) includes a number of other terms that are relevant to the regulation of mobile medical apps.

A. Mobile Platform

For purposes of this guidance, "mobile platforms" are defined as commercial off-the-shelf (COTS) computing platforms, with or without wireless connectivity, that are handheld and generally wireless in nature. Examples of these mobile platforms include mobile computers such as the iPhone®, BlackBerry® phones, Android® phones, tablet computers, or other computers that are typically used as smart phones or personal digital assistants (PDAs). Mobile platforms do not include servers, cell towers, or other infrastructure that enables (wireless or wireline) communication.

B. Mobile Application (Mobile App)

For purposes of this guidance, a mobile application or "mobile app" is defined as a software application that can be executed (run) on a mobile platform, or a web-based software application that is tailored to a mobile platform but is executed on a server.

C. Mobile Medical Application (Mobile Medical App)

For purposes of this guidance, a "mobile medical app" is a mobile app that meets the definition of "device" in section 201(h) of the Federal Food, Drug, and Cosmetic Act (FD&C Act).[4] As mentioned above, mobile medical apps are a subset of mobile apps.

D. Regulated Medical Device

For purposes of this guidance, a "regulated medical device" is defined as a product that meets the definition of "device" in section 201(h) of the FD&C Act and that has been classified by the FDA, or otherwise approved or cleared by the FDA review of a premarket application or other submission for the device. Examples of such devices are identified in Appendix B.

[4] Products that are built with or consist of computer and/or software components or applications are subject to regulation as devices when they meet the definition of a device in section 201(h) of the FD&C Act. That provision defines a device as "…an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent…..", that is "…intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man…" or "…intended to affect the structure or any function of the body of man or other animals…" Thus, software applications that run on a desktop computer, laptop computer, remotely on a website or "cloud," or on a handheld computer may be subject to device regulation if they are intended for use in the diagnosis or the cure, mitigation, treatment, or prevention of disease, or to affect the structure or any function of the body of man. The level of regulatory control necessary to assure safety and effectiveness varies based upon the risk the device presents to public health. (See Appendix B for examples). FDA does not intend to regulate all mobile apps that meet the definition of a medical device. Only the subset of mobile medical apps that are identified in this guidance document will be subject to regulatory oversight.

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¶
is used as an accessory to a regulated medical device; or¶
transforms a mobile platform into a regulated medical device.¶
¶
The intended use of a mobile app determines whether it meets the definition of a "device." As stated in 21 CFR 801.4,[5] intended use may be shown by labeling[6] claims, advertising materials, or oral or written statements by manufacturers or their representatives. When the intended use of a mobile app is for the diagnosis of disease or other conditions, or the cure, mitigation, treatment, or prevention of disease, or is intended to affect the structure or any function of the body of man, the mobile app is a device.¶
¶
One example is a light emitting diode (LED) included on a mobile platform with a mobile app to make that LED operate. If the manufacturer intends the system to illuminate objects generally (i.e., without a specific device intended use), neither the mobile app nor the mobile platform would be considered medical devices. If, however, through marketing and distribution, the mobile app is promoted by the manufacturer for use as a light source to examine patients, then the mobile app would meet the definition of a device. (In this case, the intended use of the light source would be similar to a conventional device such as an ophthalmoscope.)¶
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In general, if a mobile app is intended for use in performing a medical device function it is a medical device, regardless of the platform on which it is run. For example, mobile apps intended to run on smart phones to analyze glucose meter readings would be considered similar to software running on a desktop computer, which is regulated under 21 CFR 862.1345 ("glucose test system").

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E. Regulated Mobile Medical App

For purposes of this guidance, a "regulated mobile medical app" is defined as a mobile medical app to which the FDA intends to apply its regulatory authority.[7]

F. Mobile Medical App Manufacturer

For purposes of this guidance, a "mobile medical app manufacturer" is defined as any person or entity that manufactures, as defined in 21 CFR Parts 803, 806, and 807,[8] a regulated mobile medical application.

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The term mobile medical app manufacturer does not include entities that exclusively distribute mobile medical apps, without engaging in manufacturing functions. Furthermore, a person or entity that solely establishes an online marketplace that allows manufacturers/distributors to market their mobile apps is not a mobile medical app manufacturer or distributor and is not regulated by FDA. Examples of such online marketplaces include owners and operators of "android market", "iTunes store", and "BlackBerry App World."

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[7] For additional detail, see section V of this guidance document.

[8] Regulatory definitions of the term "manufacturer" or "manufacture" appear in 21 CFR Parts 803, 806, and 807. The Medical Device Reporting regulation defines manufacturer to mean: "any person who manufactures, prepares, propagates compounds, assembles, or processes a device by chemical, physical, biological, or other procedure. The term includes any person who either: (1) Repackages or otherwise changes the container, wrapper, or labeling of a device in furtherance of the distribution of the device from the original place of manufacture; (2) Initiates specifications for devices that are manufactured by a second party for subsequent distribution by the person initiating the specifications; (3) Manufactures components or accessories that are devices that are ready to be used and are intended to be commercially distributed and intended to be used as is, or are processed by a licensed practitioner or other qualified person to meet the needs of a particular patient; or (4) Is the U.S. agent of a foreign manufacturer." 21 CFR 803.3.

FDA's regulation requiring reports of corrections and removals defines manufacturer to mean: "any person who manufactures, prepares, propagates, compounds, assembles, or processes a device by chemical, physical, biological, or other procedures. The term includes any person who: (1) Repackages or otherwise changes the container, wrapper, or labeling of a device in furtherance of the distribution of the device from the original place of manufacture to the person who makes final delivery or sale to the ultimate user or consumer; (2) Initiates specifications for devices that are manufactured by a second party for subsequent distribution by the person initiating the specifications; or (3) Manufactures components or accessories which are devices that are ready to be used and are intended to be commercially distributed and are intended to be used as is, or are processed by a licensed practitioner or other qualified person to meet the needs of a particular patient." 21 CFR 806.2 (g).

Under FDA's establishment and registration regulation, registration and listing requirements apply to anyone engaged in the manufacture, preparation, propagation, compounding, assembly, or processing of a device, activities that are defined to include: "the making by chemical, physical, biological, or other procedures of any article that meets the definition of device in section 201(h) of the act. . . . includ[ing] the following activities: (1) Repackaging or otherwise changing the container, wrapper, or labeling of any device package in furtherance of the distribution of the device from the original place of manufacture to the person who makes final delivery or sale to the ultimate consumer; (2) Initial importation of devices manufactured in foreign establishments; or (3) Initiation of specifications for devices that are manufactured by a second party for subsequent commercial distribution by the person initiating specifications." 21 CFR 807.3(d).

A mobile medical app manufacturer includes anyone who initiates specifications, designs, labels, or creates, in whole or from multiple components, a regulated mobile medical app or software system that includes a regulated mobile medical app. Examples of mobile medical device manufacturers include any person or entity that:

- **Creates, designs, develops, labels, re-labels, remanufactures, modifies, or creates a regulated mobile medical app or software system from multiple components that includes a regulated mobile medical app.** This includes a person or entity that creates a mobile app by using COTS software components and markets the product to perform as a regulated mobile medical app;

- **Provides regulated mobile medical app functionality through a "web service" or "web support" for use on a mobile platform.** For example, a manufacturer of a regulated mobile medical app that allows users to access the application's medical device functionality over the web is considered a mobile medical app manufacturer; or

- **Initiates specifications or requirements for a regulated mobile medical app or procures product development/manufacturing services from other individuals or entities (second party) for subsequent commercial distribution.** For example, when a "developer" (i.e., an entity that provides engineering, design, and development services) creates a regulated mobile medical app from the specifications that were initiated by the "author," the "author" who initiated and developed specifications for the regulated mobile medical app is considered a "manufacturer" under 21 CFR 803.3. For purposes of this guidance, manufacturers of a regulated mobile medical app would include persons or entities who are the creators of the original idea (initial specifications) for a regulated mobile medical app, unless another entity assumes all responsibility for manufacturing and distributing the regulated mobile medical app, in which case that other entity would be the "manufacturer."[9] Software "developers" of a regulated mobile medical app that are only responsible for performing design and development activities to transform the author's specifications into a regulated mobile medical app would not constitute manufacturers, and instead the author would be considered the manufacturer.

For purposes of this guidance, the term mobile medical app manufacturer does not include mobile platform manufacturer.[10]

[9] See 21 CFR 803.3 (definition of manufacturer) & 807.20(a)(2).

[10] A mobile platform manufacturer that commercially markets a mobile platform with an intended use (as defined in 21 CFR 801.4) of, or to be used with, a device is considered a device manufacturer under 21 CFR 803, 806 and 807. In contrast, a mobile platform manufacturer that solely distributes or markets its platform with no device intended use is unregulated and is excluded from FDA regulations. In other words, the fact that a mobile platform could be used to run a regulated mobile medical app identified by this guidance does not mean that the mobile platform manufacturer is considered a medical device manufacturer. For example, if it is possible to run regulated mobile medical apps on BrandNamePhone but BrandNamePhone is not marketed by BrandNameCompany with a medical device intended use, then BrandNameCompany would not be a medical device manufacturer.

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<#>Creates a mobile medical app intended to be used on a mobile platform, or that manufactures a mobile app to be supported by hardware attachments to the mobile platform with a device intended use.¶

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IV. Scope

This guidance explains FDA's intention to apply its regulatory requirements to a subset of mobile apps. This subset, which we are calling regulated mobile medical apps, focus on moderate- to high-risk products, as determined by their intended use. These regulated mobile medical apps are described in section V.

This guidance does not specifically address wireless safety considerations, classification and submission requirements related to clinical decision support software, or the application of quality systems to software. The FDA intends to address these topics through separate guidance(s).

V. Regulatory approach for mobile medical apps

The FDA recognizes the extensive variety of actual and potential functions of mobile apps, the rapid pace of innovation in mobile apps, and potential benefits and risks to public health. Some manufacturers of mobile medical apps have sought premarket clearance for their devices; however, many may be unsure about how the FDA regulations apply to their products.

As described in this guidance, the FDA plans to apply its regulatory oversight only to certain types of mobile apps. **This narrowly-tailored approach focuses on a subset of mobile apps that either have traditionally been considered medical devices or affect the performance or functionality of a currently regulated medical device.** The FDA believes that this subset of mobile apps poses the same or similar potential risk to the public health as currently regulated devices if they fail to function as intended. Using mobile or other innovative platforms along with a mobile medical app to perform medical device functions does not necessarily change the intended use or the risk to patients if the device fails to operate properly. FDA intends to regulate only those mobile medical apps that involve moderate- to high-risk.[14]

Some mobile apps that do not meet the definition of a regulated mobile medical app may meet the FD&C Act's definition of a device; FDA intends to exercise enforcement discretion[15] towards these mobile apps (i.e., mobile medical apps that are not regulated as described in this guidance). The FDA intends to monitor the performance of certain[16] mobile medical apps that are outside of

[14] To determine whether a mobile app is a regulated mobile medical app, see section V.A.

[15] This means that the FDA intends to exercise its discretion to decline to pursue enforcement actions for violations of the FD&C Act and applicable regulations by a manufacturer of a mobile medical app, as specified in this guidance. This does not constitute a change in the requirements of the FD&C Act or any applicable regulations. Section V.A describes criteria by which FDA will determine whether to exercise enforcement discretion.

[16] The FDA's review of these products indicates that the majority of these mobile apps that may meet the definition of a medical device have functionality either to automate common medical knowledge available in the medical literature or to allow individuals to self-manage their disease or condition. Many of these mobile medical apps also automate common clinician's diagnostic and treatment tasks using simple general purpose tools, including spreadsheets, timers, or other general computer applications, by performing logging and tracking. Examples of mobile medical apps that will not be regulated at this time but will be monitored by the Agency include those that: log, track, and graph manually-entered (keyed in) data that lead to reminders or alarms associated with diagnosis or

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are used as an accessory to a regulated medical device; or¶
transform a mobile platform into a regulated medical device

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This guidance is limited only to mobile medical apps. The following examples represent mobile apps that FDA does **not** consider to be mobile medical apps for purposes of this guidance:¶
<#>**Mobile apps that are electronic "copies" of medical textbooks, teaching aids or reference materials, or are solely used to provide clinicians with training or reinforce training previously received.** These types of apps do not contain any patient-specific information, but could show examples for a specific medical specialty. Examples of such medical text books include the electronic Physician's Desk Reference and similar reference materials that are typically used as part of course instruction and are implemented as electronic books. Exemplary teaching aids and reference materials include: flash cards or quizzes that are used for training purposes or as reference material (e.g., with preloaded medical images, conditions, pictures, graphs, etc.); slideshows of common conditions; lists of medical terminology; and review materials that are to be used by medical students during training. (In contrast, mobile apps that allow the user to input patient-specific information along with reference material to automatically diagnose a disease or condition are considered mobile medical apps).¶
¶
<#>**Mobile apps that are solely used to log, record, track, evaluate, or make decisions or suggestions related to developing or maintaining general health and wellness.** Such decisions, suggestions, or recommendations are **not** intended for curing, treating, seeking treatment for mitigating, or diagnosing a specific disease, disorder, pat ... [1]

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the regulatory framework in this guidance and determine whether additional or different actions are necessary to protect the public health. A manufacturer may, however, at its discretion, elect to register and list, and to seek approval or clearance from the FDA for these mobile medical apps.

Nevertheless, the FDA strongly recommends that manufacturers of all mobile medical apps follow the Quality Systems[17] regulations (which include good manufacturing practices) in the design and development of their mobile medical apps and initiate prompt corrections to their mobile medical apps, when appropriate, to prevent patient and user harm because the FDA has found that the majority of software-related device failures are due to design errors. In one study, the most common problem was failure to validate software prior to routine maintenance.[18]

For the subset of mobile medical apps that are subject to regulatory oversight, manufacturers must meet the requirements associated with the applicable device classification. If a mobile medical app, on its own, falls within a medical device classification, its manufacturer is subject to the requirements associated with that classification. A regulated mobile medical app, like other devices, may be classified as Class I (general controls), Class II (special controls in addition to general controls), or Class III (premarket approval).[19]

The FDA has typically expected that the manufacturer of an accessory would meet the requirements associated with the classification of the connected device. However, this approach may not be well-suited for mobile medical apps that serve as an accessory to another medical device because of the wide variety of functions mobile medical apps can potentially perform.[20] See section V.B for a description of the regulatory approach that FDA intends to apply to mobile medical apps as accessories.

Finally, if a regulated mobile medical app adds medical device functionality to a mobile platform, the mobile medical app manufacturer (as opposed to the mobile platform manufacturer) is responsible for ensuring that the regulated mobile medical app meets the classification requirements applicable to that functionality.[21]

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Deleted: Therefore, FDA is seeking comment on how it should approach mobile medical apps that are accessories to other medical devices so safety and effectiveness can be reasonably assured. Mobile medical devices that are intended to be used as accessories to a regulated medical device may do so for purposes of (a) displaying, analyzing, storing, or transmitting patient-specific medical device data, or (b) controlling the operation, function, or energy source of the medical device (see Appendix A for examples).

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treatment of a disease or medical condition; act as data viewers for patient education; organize, store, and display personal health data, such as lab results, doctor visits, dosages, calories consumed, etc.; or allow for general dose over the counter (OTC) lookups and use drug labeling to provide information that is typically available on a drug label, e.g., acetaminophen dosage for children and adults.

[17] *See* 21 CFR part 820.

[18] See Final Rule, Current Good Manufacturing Practice (CGMP); Quality System Regulation, 61 FR 52602 (October 7, 1996).

[19] *See* fns. 3 and 4.

[20] For example, mobile medical apps that are intended to be used as accessories to a regulated medical device may do so for purposes of (a) displaying, analyzing, storing, or transmitting patient-specific medical device data, or (b) controlling the operation, function, or energy source of the medical device (see Appendix A for specific examples).

[21] As previously noted, the mobile platform manufacturer would not be subject to FDA regulation unless that person or entity intends for the mobile platform to be used as a medical device. The mere fact that the mobile medical app manufacturer intends for its regulated mobile medical app to be used on a mobile platform does not cause the mobile platform to become a medical device.

A. Criteria for determining whether a mobile medical app will be regulated

Mobile apps may take a number of forms, but it is important to note that the FDA will apply its regulatory oversight to only the subset of mobile medical apps as expressed in this guidance.

The intended use of a mobile app determines whether it meets the definition of a "device." As stated in 21 CFR 801.4,[22] intended use may be shown by labeling[23] claims, advertising materials, or oral or written statements by manufacturers or their representatives. When the intended use of a mobile app is for the diagnosis of disease or other conditions, or the cure, mitigation, treatment, or prevention of disease, or is intended to affect the structure or any function of the body of man, the mobile app is a medical device regardless of the platform on which it is run.[24] For example, mobile apps intended to run on smart phones to analyze glucose meter readings would be considered similar to software running on a desktop computer, which is regulated under 21 CFR 862.1345 ("glucose test system").

There are a number of health-related mobile medical apps for which the intended use does not meet the definition of a medical device. These mobile apps are, therefore, excluded from FDA regulation. In addition, there are a number of mobile medical apps for which the intended use is currently exempt from regulation because the public health benefit outweighs the inherent low risk associated with the product.[25]

[22] "The words 'intended uses' or words of similar import … refer to the objective intent of the persons legally responsible for the labeling of devices. The intent is determined by such persons' expressions or may be shown by the circumstances surrounding the distribution of the article. This objective intent may, for example, be shown by labeling claims, advertising matter, or oral or written statements by such persons or their representatives. It may be shown by the circumstances that the article is, with the knowledge of such persons or their representatives, offered and used for a purpose for which it is neither labeled nor advertised. The intended uses of an article may change after it has been introduced into interstate commerce by its manufacturer. If, for example, a packer, distributor, or seller intends an article for different uses than those intended by the person from whom he received the devices, such packer, distributor, or seller is required to supply adequate labeling in accordance with the new intended uses. But if a manufacturer knows, or has knowledge of facts that would give him notice that a device introduced into interstate commerce by him is to be used for conditions, purposes, or uses other than the ones for which he offers it, he is required to provide adequate labeling for such a device which accords with such other uses to which the article is to be put." 21 CFR 801.4.

[23] "The term 'labeling' means all labels and other written, printed, or graphic matter (1) upon any article or any of its containers or wrappers, or (2) accompanying such article." Section 201(m) of the FD&C Act, 21 U.S.C. § 321(m).

[24] One example is a light emitting diode (LED) included on a mobile platform with a mobile app to make that LED operate. If the manufacturer intends the system to illuminate objects generally (i.e., without a specific device intended use), neither the mobile app nor the mobile platform would be considered medical devices. If, however, through marketing and distribution, the mobile app is promoted by the manufacturer for use as a light source to examine patients, then the mobile app would meet the definition of a device. (In this case, the intended use of the light source would be similar to a conventional device such as an ophthalmoscope.)

[25] Regulation of these mobile medical apps would remove the potential benefit to public health that such apps will undoubtedly deliver. FDA believes that the claims associated with these mobile medical apps pertain to medical issues that are so well-resolved that inclusion of the product claim should be exempt from regulation because: 1) the claims serve as an essential and powerful educational tool for consumers to learn about the benefit of lifestyle and behavioral modification; 2) education is a proven method of effectively modifying human behavior; and 3) the nature of the claims will greatly improve public awareness and subsequent education on the benefits of proactively preserving health.

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Similarly, mobile medical apps that transform a mobile platform into a regulated medical device may do so by using attachments, display screens, sensors, or other such methods (see Appendix A for examples).

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In order to determine whether a mobile app is a regulated mobile medical app, FDA intends to use the approach described below.

1. Intended use claims for mobile apps that are *excluded* from FDA regulation

FDA believes that certain mobile apps involve wellness purposes that fall outside of the definition of a medical device and, therefore, are excluded from (i.e., not subject to) regulation because either the mobile app is not acting to diagnose, treat, or prevent a disease or medical condition or the associated condition is not a disease. For mobile apps in the "gray zone",[26] inherent risk should be considered.

For a mobile app to be excluded from FDA regulation, the intended use claim must not be a disease claim, as demonstrated by one of the following being true:

1. The condition for which the product is intended to be used is not a) specifically identifiable, or b) a specific disease recognized by the American Medical Association or similar medical professional organizations (e.g., general health, weight, pain/discomfort, stress, stress-related hair loss, etc.);
2. The intended use of the product targets behavioral activities (e.g., exercise, sleep, nutrition, relaxation, smoking cessation, play games, etc.) not generally associated with a specific disease; or
3. The product is intended for use by a caregiver and/or a consumer.

In addition, this exclusion requires that:

1. For products that involve a health care professional, the product must not be intended for real-time or daily monitoring of behavioral activities that are specifically identified to diagnose, prevent, or treat a disease. An example of a product that would fall outside of this exclusion is a product intended to allow a health care professional to monitor daily exercise activity of a patient being treated for morbid obesity.
2. For products that involve the exchange or display of patient health information, the product must not be intended for review by a health care professional as a means of diagnosing, treating, or preventing a disease or medical condition.

Health claims for products that are eligible for exclusion may include certain terms that distinguish the intended use from that of a disease claim, such as those listed in Figure 1.

[26] The "gray zone" can result from the use of general language as well as degrees of interpretation of specific terms used in the claims.

Figure 1: Example "Health" Terms that Should Not Automatically Trigger FDA Regulation[27]

• Health, wellness or well-being	• Stress or stress management
• Satisfaction or happiness	• Hospitalization
• Heart health	• Challenge or game
• General health	• Personal use
• Overall health	• Non-diagnostic-quality
• Unhealthy	• Sleep deprivation

Examples of these types of claims include:

- "A web-based software app that provides mind challenging games and tracks scores and other parameters for review by a life coach for the elderly."
- "A SMS text system that provides daily motivational tips to reduce stress and promote a positive mental outlook."

2. Intended use claims for mobile medical apps that are *exempted* from FDA regulation

Mobile medical apps that should be exempted from FDA regulation involve at least two general categories of claims: 1) Impact Claims; and 2) Information Claims.[28]

Impact Claims include statements that suggest the mobile medical app can: 1) "reduce the risk of" a particular disease or medical condition; or 2) "improve" or "maintain" a particular aspect of an individual's health or medical condition. To be eligible for this exemption, the Impact Claim must meet each of the following:

1. The claim is a generally recognized health claim and not a disease claim;
2. The claim language is adequately qualified by *may*, *might*, or other similar language;
3. The mechanism by which the product functions to "reduce the risk of", "improve", or "maintain" the specified health-related condition does not involve invasive procedures.

Examples of Impact Claims include:

- "A mobile app that may reduce the risk of heart disease by actively monitoring and trending exercise activity on a daily basis."
- "A cloud-based personal health storage system that may improve your quality of life by allowing friends and family to review your behavioral activities in order to support you in your effort to quit smoking."

[27] This list is not exhaustive; instead, these are examples to demonstrate the general principle that references to general health or personal wellness do not per se constitute disease claims.

[28] These two categories of claims are not mutually exclusive of each other and depend on the type of claim being evaluated. For example, a mobile medical app may be considered "not regulated" based on the associated impact claims, yet be "regulated" as a result of the associated information claims.

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Information Claims include statements that suggest the mobile medical app is designed to: 1) "collect" or "aggregate" diagnostic information; 2) "capture" or "detect" changes in an individual's health or medical condition; or 3) "alert" or "notify" a consumer, patient, caregiver, or health care professional of a non-acute health or medical condition. To be eligible for this exemption, the Information Claim must meet each of the following:

1. The information collected or analyzed must be either:
   a) Medical data that are manually or electronically collected and entered; or
   b) Wellness data;
2. The results of the function performed on the information must not be transferred to a medical device for further analysis or to control the medical device;
3. The monitoring and/or notification functions must be intended only for use by:
   a) A consumer or caregiver;
   b) A health care professional not acting in their professional capacity; or
   c) A health care professional performing record-keeping or non-acute monitoring activities; and
4. The condition that the product is intended to monitor and/or about which the product is intended to notify the consumer or caregiver must not warrant the involvement of a health care professional to actively monitor the person's medical condition.

The use of these data by a health care professional does not automatically exclude a product from this exemption. The determination depends on the manufacturer's claims as to the intended use of the data by a health care professional.

Examples of Information Claims include:

- "A sensor system and web-based software app to collect, monitor, and store sleep parameters (e.g., duration and frequency of REM and non-REM sleep, etc.) for review by a behavioral/health coach."
- "A sensor system and smartphone app for use by a school nurse to monitor and alert the user of allergens in the school cafeteria and/or air pollen/pollutants on the school playground."

A mobile medical app that does not meet an exemption would be subject to FDA regulation.

B. Approach to mobile medical apps as accessories

Comment [jb1]: In the MRC's comment letter, we responded to FDA's request for feedback on their proposed regulatory approach to accessories. In our response, we enumerated a number of changes to the proposed approach that FDA should implement in the near-term. We indicated, however, that in the long-term, FDA should establish classification regulations that appropriately classify mHealth accessories based on their risk. This section describes our suggested long-term approach. If FDA chooses to implement the near-term approach as described in our comment letter, FDA would need to replace this section with details consistent with our near-term solution.

In the future, everything that produces or receives medical device data, including mobile medical apps, whether therapeutic or diagnostic, is likely to be connected to a network. So, for example, a blood glucose meter will be connected to a cell phone, which will connect to a cell tower, which will connect to a local area network, which will connect to a server, which will dump data in an EMR, which a physician will view on a tablet or smartphone.

Historically, the "accessory rule" has been thought of as an overarching rule, broadly applicable to

nearly all so-called *parent device-accessory* connections. Under that rule, in certain situations,[29] FDA regulates a product that is an "accessory" to a medical device as if in the *same regulatory classification* as the "parent" medical device. The theory has been simply: if an accessory malfunctions, the risk to the patient would be the same as if the parent medical device malfunctioned. So, for a modern example, take an EMR that is indirectly connected to a blood glucose meter by way of three other low- risk Class I medical devices that are interconnected and passing data among one another. If one of those devices ultimately connects to the glucose meter, the EMR receiving data from the Class II blood glucose meter would receive a Class II designation—as would the other medical devices in this example. This results in regulatory excess, as harmless widgets would obtain the highest regulatory scrutiny just because they utilize data from a medical device with a higher classification.

The developing mobile medical app industry has raised significant questions about the scope of the accessory rule, due to the inherent interconnectedness of mobile health ("mHealth") products. These questions are likely to become more complicated, as many products will be marketed in the future with broad system claims, rather than one-to-one pairing claims. This section describes FDA's current thinking on the regulation of traditional accessories in an mHealth system.

1. Policy Overview

Instead of deriving the regulatory classification from the data-generating parent device, FDA intends to take a different conceptual approach,[30] with two key prongs:

1. FDA intends to publish classification regulations for commonly used accessories. Much like with FDA's recent MDDS rule, the purpose here would be to establish more appropriate, risk-based classifications specific to the accessories that make up the various "families" within the family tree of connected products. The specific classification that defines a generic family of accessories should trump any classification derived from the data generator within a given tree.

2. FDA intends to regulate claims of compatibility between accessories in a family and the data-generating medical devices (traditionally treated as *parent* devices) by requiring that the firm making the claim provide adequate support to underpin the claim. If the device made by the manufacturer making the claim is Class II or III, the claim substantiation would need to be included in the submission to FDA. The manufacturer making the compatibility claim will also need to have some assurance that the claim will remain true (e.g., by agreements between manufacturers, through its quality system, or by compliance with key standards).

The following sections describe this policy in more detail.

[29] Generally, FDA regulates a product as an accessory to (and in the same classification as) a specific medical device when the manufacturer of the product intends for it to be used with that medical device or when the medical device manufacturer requires the use of the product (which is sold separately) with that medical device.

[30] This conceptual approach applies to regulated mobile medical apps as well as other types of products (hardware or software) in an mHealth system.

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2. Regulation of Mobile Medical Apps as Accessory Devices in an mHealth System

The fundamental concept of this new approach to regulation of accessories is that the traditional accessory rule applies if and only if there is not an existing classification for the mHealth device in question. The first step for determining whether a product is subject to the accessory rule is to consider whether the product is a device at all based on the product's intended use. If it is not, the analysis ends because the product is unregulated. If the product is a regulated mobile medical app, the next question is whether it meets an existing classification regulation based on its intended use.[31] If a regulated mobile medical app falls within an existing classification regulation, then the regulated mobile medical app will be subject to that classification and the relevant controls contained within the applicable section of the CFR.[32] To meet the definition of the classification regulation, the design and intended use of the device must not exceed the boundaries of the generic product type, including any applicable limitations (e.g., 8xx.9 regulations).

For those classification regulations that are exempt from 510(k) requirements, a regulated mobile medical app will remain exempt if it:

1. Has existing or reasonably foreseeable characteristics of other devices in the classification category; and
2. Has the same intended use and fundamental scientific technology as another device in the classification category.

A regulated mobile medical app (or any other mHealth device) associated with an in vitro diagnostic device is subject to additional exemption limitations under the 8xx.9 regulations. In addition to the requirements above, a regulated mobile medical app of this type will remain in its existing classification regulation and exempt from 510(k) requirements if: 1) the device is a low-risk device (as determined by the intended use criteria described above and under the risk model described in Appendix E); and 2) the device does not change the risk profile of the associated in vitro diagnostic device.

[31] When considering the appropriate classification of a new device, classification is evaluated by first determining whether FDA has previously classified and described a similar device type in the Code of Federal Regulations (CFR). The classification and descriptions of device types are organized by medical specialty panels in 21 CFR Parts 862 through 892.

[32] The existence of a regulatory classification of a medical device type is the agency's recognition that a given device type should fall within a specified device classification, even if that device happens to be an accessory or compatible with other devices. The medical device data systems (MDDS) Final Rule recognizes this fundamental principle of FDA regulation:

> If the product meets the definition of an MDDS because it is limited to the intended uses of an MDDS, FDA will regulate such a product as an MDDS, not as an accessory to or component of another device, regardless of how many particular devices or device types the product supports. FDA recognizes that some devices that meet the definition of an MDDS may have been previously cleared as accessories to other device types. Through enactment of this regulation, devices that are considered MDDSs will now be classified as class I, Exempt, whether they are existing devices or new/modified devices that are now defined as MDDS.

Medical Devices; Medical Device Data Systems, 76 Fed. Reg. 8637, 8644 (Feb. 15, 2011) (to be codified at 21 C.F.R. § 880.6310), *available at* http://www.gpo.gov/fdsys/pkg/FR-2011-02-15/pdf/2011-3321.pdf.

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A low-risk mobile medical app is not *per se* restricted from exemption under the 8xx.9 limitation, even if the intended use is any of the following:

1. For assessing the risk of cardiovascular disease;
2. For use in diabetes management;
3. For identifying or inferring the identity of a microorganism directly from clinical material; or
4. For near-patient testing (point of care).

FDA intends to use the 8xx.9 limitations judiciously and not to exclude a regulated mobile medical app from a classification regulation simply because that product connects to another medical device in an mHealth system or the product at issue has different characteristics than other devices. In determining whether the 8xx.9 regulation will exclude a device from a specific classification regulation, a manufacturer should conduct a risk assessment. If the risk assessment supports the Class I or II exempt classification, the device should remain within the boundaries of the existing classification.[33]

If the regulated mobile medical app does not fit within an existing classification, the regulated mobile medical app manufacturer may avoid the accessory rule by requesting that FDA determine the device classification through the *de novo* review process. The *de novo* review process is an opportunity for a device automatically designated as Class III to be reclassified as a Class I or II device, if appropriate.[34] Applicants should support their *de novo* submission by a risk assessment that demonstrates the lower risk profile of the device.[35] FDA or any stakeholder may also employ any other available route to reclassification.

If the mobile medical app manufacturer does not pursue the *de novo* review process (or any other form of reclassification) and the regulated mobile medical app is intended to be used with another medical device in an mHealth system, the regulated mobile medical app becomes an accessory and takes on that device classification of the connected medical device.[36]

If the regulated mobile medical app is not intended to be used with another medical device, the regulated mobile medical app is not an accessory and, instead, will be automatically subject to a

[33] Appendix B of this document lists current regulatory classifications that are useful for regulated mobile medical apps as accessories.

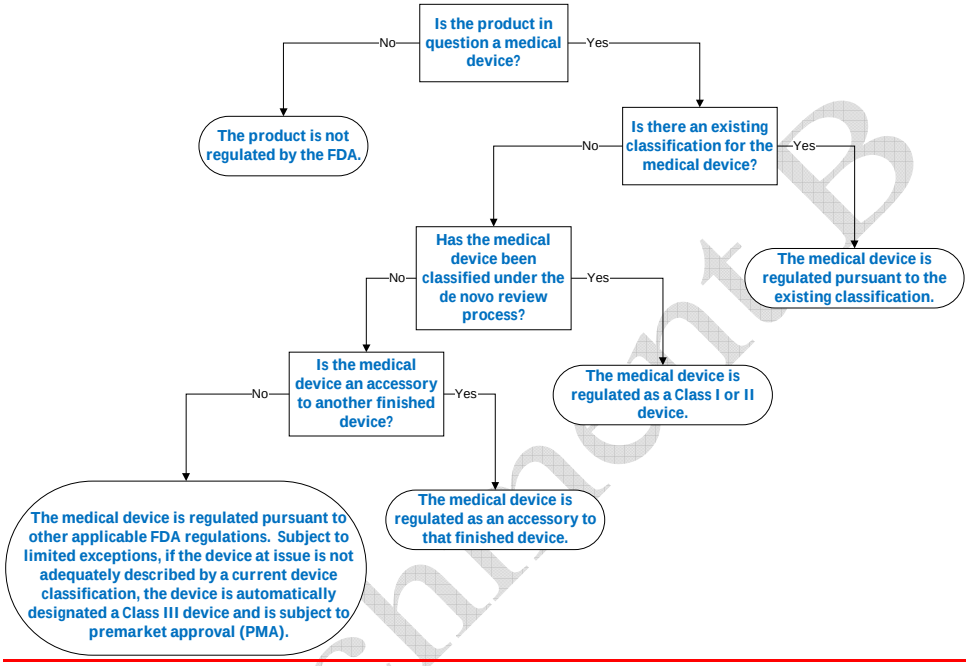
[34] A device manufacturer may petition FDA to regulate the device as a Class I or II medical device independent of the other products in the mHealth system. The *de novo* process, established in § 513(f)(2) of the Federal Food Drug & Cosmetic Act, is particularly appropriate for low risk devices. The *de novo* process will be useful for mHealth devices, including regulated mobile medical apps, and the creation of needed regulatory classifications. FDA should use this process more frequently to create consistency and predictability in the regulation of mHealth devices.

[35] The existing guidance on the *de novo* process also should be used to guide application content.

[36] Inherent in this analysis is the assumption that the device is a finished product rather than a *component* to another finished product. The difference between an accessory and a component is important because it determines the applicable regulatory requirements for a particular product. Components are exempt from most FDA regulatory requirements, with the regulatory burdens being borne by the finished device manufacturer. Accessories, on the other hand, because they go right to the end user, must meet the FDA requirements before they leave the hands of the accessory manufacturer.

premarket approval submission as a Class III device.[37] Figure 2 summarizes this analysis.

Figure 2: Framework for Regulation of Mobile Medical Apps as Accessories



3. Claims of Compatibility

A claim of compatibility between two medical devices in an mHealth system (e.g., a regulated mobile medical app and a blood pressure cuff) does not render a parent device-accessory relationship between the two products. The analysis described above determines whether a regulated mobile medical app is an accessory. The claim of compatibility, however, must be substantiated through adequate validation.

Take, for example, a weight scale (and its associated mobile app) that claims compatibility with a specific brand of blood glucose meters. The scale is not regulated as an accessory to the blood glucose meter because the scale has its own classification.[38] However, the manufacturer of the scale must validate its claims of compatibility with the blood glucose meter. If the manufacturer of the blood glucose meter claims compatibility with the scale, the manufacturer must validate that its blood glucose meter is compatible with the scale. The burden lies on the manufacturer making the

[37] Appendix F describes other considerations that may impact this analysis.
[38] The scale is regulated as a Class I device under 21 C.F.R. § 880.2700. The blood glucose meter is regulated as a Class II device under 21 C.F.R. § 862.1345.

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claim of compatibility to substantiate the claim through adequate validation.

FDA should also consider using a feasibility test to determine the significance of the validation. If it is feasible for the manufacturer (at the time the product is created) to self-assess the product as a low-risk device, the validation requirements should be minimal.

Claims of compatibility should be substantiated to demonstrate that the associated risk is recognized and minimized. Even though a lower-class device is not up-regulated, the claim substantiation process ensures the risk associated with the two products is low. Claim substantiation is separate and apart from the determination of whether a device is an accessory or its appropriate classification.

Claim substantiation requires both present and future validation by the claim maker.[39] Present substantiation consists of validation testing to ensure that the claim of compatibility is accurate and to clarify the design specifications that support the claim. Future substantiation consists of the establishment of a quality system and on-going validation testing whenever changes to either article are made. This may involve either control of the design of both devices (e.g., by ownership) or an agreement between the claim maker and the manufacturer of the product that design specifications will not change or that notification will be given in advance of any changes to allow the claim maker to adequately address the impact of such changes on the future substantiation of the claim. In the absence of such an agreement, the claim maker would need to assess the risk to show that an agreement is not necessary.

C. Examples of regulated mobile medical apps

The following examples represent mobile medical apps that FDA consider to be subject to its regulatory oversight:

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- **Mobile apps that are an extension of one or more medical device(s) by connecting[40] to such device(s) for purposes of controlling the device(s) or displaying, storing, analyzing, or transmitting patient-specific medical device data.** Examples of displays of patient-specific medical device data include remote display of data from bedside monitors, display of previously stored EEG waveforms, and display of medical images directly from a Picture Archiving and Communication System (PACS) server, or similar display functions that meet the definition of an MDDS. Examples of mobile apps that control medical devices include apps that provide the ability to control inflation and deflation of a blood pressure cuff through a mobile platform and mobile apps that control the delivery of insulin on an insulin pump by transmitting control signals to the pumps from the mobile platform.

- **Mobile apps that transform the mobile platform into a medical device by using attachments, display screens, or sensors or by including functionalities similar to**

[39] Some types of device relationships trigger additional regulatory obligations.

[40] To meet this criterion, the mobile medical apps need not be physically connected to the regulated medical device.

those of currently regulated medical devices. Examples include a mobile app that uses a mobile platform for medical device functions, such as attachment of a transducer to a mobile platform to function as a stethoscope, attachment of a blood glucose strip reader to a mobile platform to function as a glucose meter, or attachment of electrocardiograph (ECG) electrodes to a mobile platform to measure, store, and display ECG signals; or, a mobile app that uses the built-in accelerometer on a mobile platform to collect motion information for monitoring sleep apnea.

To further clarify, the following categories identify the types of regulated mobile medical apps and their associated classifications.

- **Displaying, storing or transmitting patient-specific medical device data in its original format –** Mobile medical apps with this functionality constitute an MDDS (21 CFR 880.6310) and are subject to Class I requirements (general controls).[41]
- **Controlling the intended use, function, modes, or energy source of the connected medical device –** Mobile medical apps of this type are subject to the accessory analysis described above and may be considered an accessory to the connected device.[42]
- **Transforming or making the mobile platform into a regulated medical device** – Mobile medical apps that use attachments, display screens, sensors or other such similar components to transform a mobile platform into a regulated medical device are required to comply with the device classification associated with the transformed platform.[43] For example, a mobile medical app that uses sensors (internal or external) on a mobile platform for electronic stethoscope functions is considered to convert the mobile platform into an electronic stethoscope; manufacturers of such a mobile medical app are required to follow the requirements of 21 CFR 870.1875(b) (Electronic Stethoscope). Similarly, a mobile medical app that displays radiological images for diagnosis transforms the mobile platform into a Class II PACS under 21 CFR 892.2050. The FDA has already cleared such mobile medical apps.

[41] The FDA believes that requiring general controls sufficiently manage the risks for mobile medical apps that are used as a secondary display to a regulated medical device and are not intended for providing primary diagnosis or treatment decisions (i.e. mobile medical apps that meet the MDDS definition).

[42] In many cases such a mobile medical app extends the use and functionality of the connected medical device. As a result, the mobile medical app would likely be required to comply with the regulations applicable to the connected medical device in order to address any associated risks.

[43] To be clear, the mobile platform would not be subject to FDA regulation unless the mobile platform manufacturer intended the mobile platform to meet the definition of a medical device.

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<#>**Mobile apps that allow the user to input patient-specific information and - using formulae or processing algorithms - output a patient-specific result, diagnosis, or treatment recommendation to be used in clinical practice or to assist in making clinical decisions.** Examples include mobile apps that provide a questionnaire for collecting patient-specific lab results and compute the prognosis of a particular condition or disease, perform calculations that result in an index or score, calculate dosage for a specific medication or radiation treatment, or provide recommendations that aid a clinician in making a diagnosis or selecting a specific treatment for a patient.¶

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Deleted: , which include adequate design controls, registration, device listing, adverse event reporting, and corrections and removals

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Deleted: and are required to comply with the controls applicable to that connected device. The FDA considers such a mobile medical app to extend the use and functionality of the connected medical device. As a result, the mobile medical app would be required to comply with the regulations applicable to the connected medical device in order to address any associated risks.

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- **Creating alarms, recommendations or creating new information (data) by analyzing or interpreting medical device data** – Mobile medical apps of this type that analyze or interpret data (electronically collected or manually entered) from another medical device have typically been previously classified under the same regulations as the connected device. For example, software that analyzes blood glucose readings to help manage diabetes has been classified as part of a "Glucose Test System" under 21 CFR 862.1345. In addition, the FDA has cleared several mobile medical apps with attachments to a mobile platform, including patient monitoring mobile apps that are classified as cardiac monitoring software under 21 CFR 870.2300 (Cardiac monitor). Other mobile medical apps that use a hardware attachment or interface to a monitoring system that have been cleared include an automatic electronic blood pressure monitor (21 CFR 870.1130) and a perinatal monitoring system (21 CFR 884.2740).

Regulated mobile medical apps intended to analyze, process, or interpret medical device data (electronically collected or manually entered) from more than one medical device should be regulated based on the associated risk. Requiring such mobile medical apps to comply with the same requirements as their connected devices may not be appropriate in many cases.[44] The FDA encourages manufacturers of such mobile medical apps to contact the Agency to determine the classification of their mobile app.

D. Examples of mobile medical apps that are not regulated

This guidance is limited only to regulated mobile medical apps. The following are general examples of mobile apps that FDA does **not** consider to be regulated mobile medical apps for purposes of this guidance:

- **Mobile apps that are electronic "copies" of medical textbooks, teaching aids or reference materials, or are solely used to provide clinicians with training or reinforce training previously received.** These types of apps do not contain any patient-specific information, but could show examples for a specific medical specialty. Examples of such medical text books include the electronic Physician's Desk Reference and similar reference materials that are typically used as part of course instruction and are implemented as electronic books. Exemplary teaching aids and reference materials include: flash cards or quizzes that are used for training purposes or as reference material (e.g., with preloaded medical images, conditions, pictures, graphs, etc.); slideshows of common conditions; lists of medical terminology; and review materials that are to be used by medical students during training.

[44] For example, analysis of Class I device information along with other demographic information can result in an interpretation of a highly acute patient condition, which presents a greater risk than the connected Class I device. On the other hand, an analysis or interpretation of data from Class II or Class III devices can lead to a simple informational result, with minimal implications or risks to public health and patient safety—in other words, a level of risk more characteristic of a Class I device. The FDA has previously classified software that calculates a drug dose based on a patient's height, weight, mass, and other patient-specific information as a "Drug Dose Calculator" under 21 CFR 868.1890. Ultimately a risk-based analysis should be performed to detemrine the classification designation.

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Deleted: are considered an accessory to that medical device. These mobile medical apps are generally required to comply with the device classification associated with that other medical device. These types of systems

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- **Mobile apps that are solely used to log, record, track, evaluate, or make decisions or suggestions related to developing or maintaining general health and wellness.**[45] Such decisions, suggestions, or recommendations are **not** intended for curing, treating, seeking treatment for mitigating, or diagnosing a specific disease, disorder, patient state, or any specific, identifiable health condition. Examples of these apps include dietary tracking logs, appointment reminders, dietary suggestions based on a calorie counter, posture suggestions, exercise suggestions, or similar decision tools that generally relate to a healthy lifestyle and wellness.

- **Mobile apps that only automate general office operations with functionalities that include billing, inventory, appointments, or insurance transactions.** Examples include: apps that determine billing codes like ICD-9 (international statistical classification of diseases); medical business accounting functions and aids that track and trend billable hours, procedures, and reminders for scheduled medical appointments or blood donation appointments; apps that automate functions such as collecting patient histories that replace paper-based entry; apps that enable insurance claims data collection and processing; and other apps that are similarly administrative in nature.

- **Mobile apps that are generic aids that assist users but are not commercially marketed for a specific medical indication.** Examples include apps that use the mobile platform as a magnifying glass (but **not** specifically for medical purposes),[46] recording audio, note-taking, replaying audio with amplification, and other similar functionalities.

- **Mobile apps that perform the functionality of an electronic health record, electronic medical record, or personal health record system.**[47]

To clarify the list above, the following are examples of mobile apps that do not meet the definition of a medical device based on the exclusion criteria described in section V.A:

- Mobile apps that alert a caregiver of a low-risk health event.

[45] The phrase *general health and wellness* refers to a product that is intended for a health-related purpose but not specifically for the diagnosis, treatment, or prevention of disease. Products that involve general health and wellness uses, therefore, do not meet the definition of a medical device. To determine whether a product is intended for general health and wellness purposes, the FDA should look at objective evidence of its intended use, including the use of any generally recognized health claims, the involvement of wellness data as opposed to medical device data, and the marketing to consumers rather than health care professionals, among other factors. For additional discussion of the factors/criteria that influence whether a product is a general health and wellness app as opposed to a regulated mobile medical app, see section V.A of this document.

[46] Medical purpose magnifiers are classified devices and regulated either under 21 CFR 886.5840 - Magnifying spectacles ("devices that consist of spectacle frames with convex lenses intended to be worn by a patient who has impaired vision to enlarge images"), or under 21 CFR 886.5540 - Low-vision magnifiers ("a device that consists of a magnifying lens intended for use by a patient who has impaired vision. The device may be held in the hand or attached to spectacles").

[47] The FDA is exercising its enforcement discretion and is not regulating EHR, EMR, and PHR systems at this time.

- Mobile apps that facilitate the monitoring of behavioral activities or basic health information (e.g., food consumption, weight trends) to evaluate general wellness of an individual.
- Mobile apps that help a consumer manage personal health information.
- Mobile apps that store, analyze, and transmit calorie consumption and/or exercise activity for personal use.
- Mobile apps that provide educational information related to medical diseases or conditions.
- Mobile apps that provide educational information, advice, or motivational guidance related to behavioral activities that may be associated with a medical disease or condition (e.g., to help quit smoking, to improve medication compliance).
- Mobile apps that allow "face-to-face" high-definition (HD) video conversations (or other means of communication, e.g., instant messenger, email, SMS text) between a consumer and a caregiver.
- Mobile apps that allow a patient or health care professional to manage administrative activities associated with the delivery of health care (e.g., electronic appointment scheduling, prescription writing/filling, billing).
- Mobile apps that allow a consumer to play "mind challenging" games.
- General communication apps that are used for telecommunications purposes to transmit data and that comply with applicable standards for such products.[48]
- General purpose health mobile apps that are used to electronically collect, store, transmit, display, or analyze (e.g., trend, aggregate, generate reports) health-related data for educational purposes or as a tool to affect normal behavioral activity (e.g., food consumption, exercise activity). An example of a general purpose health application is a mobile app stored on a smartphone that electronically collects daily exercise and weight information from a variety of sensors and displays the data for personal monitoring purposes.

The following are examples of mobile apps that technically meet the definition of a medical device but are are not regulated based on the exemption criteria described in section V.A:

- Mobile apps that send notifications to a patient to take a pill or to remind them to visit their health care professional.[49]
- Mobile apps that prompt the consumer to answer pre-determined, health-related questions.[50]
- Mobile apps that store or transmit personal health information (e.g., EMR, EHR, or PHR software) even if automatically obtained from a Class I medical device (e.g., data obtained

[48] These include products that perform the functions of wireless routers, modems, switches, Bluetooth transmitters/receivers, cables, connectors, adaptors, and any other similar product used for connectivity purposes. This also includes hardware and software drivers and accessories associated with the basic functionality of these devices.

[49] Such mobile apps simply automate a function of the health care professional or caregiver for ease-of-use.

[50] This type of product performs library functions typically associated with the activities of a health care professional or caregiver. Similarly, mobile apps that transmit this information to a health care professional or caregiver in a report are unregulated because such software automates the report-writing and record-keeping function of a health care professional or caregiver for ease-of-use. The location where the mobile app executes or is used (i.e., on a device in the consumer's home or a health care professional's office, on a third-party cloud server) does not affect the regulatory status.

from an electronic blood pressure cuff). More specifically, EMR software that stores or transmits (e.g., to another EMR software system) personal health information (including data from a Class I device, e.g., blood pressure measurements) is unregulated such that once the information enters the EMR software, it can be stored and transmitted freely throughout the EMR system and to other EMR systems without triggering FDA regulation. Similarly, mobile apps that allow an individual to manually enter personal health information (including medical device data) is unregulated.

- Mobile apps that calculate and graphically display trends in personal health incidents (e.g., hospitalization rates or alert notification rates). Similarly, mobile apps that generate a report based on data stored in an EMR, EHR, or PHR system are unregulated.
- Mobile apps that control the equipment used to communicate health-related information from one location to another.
- Mobile apps that allow a "face-to-face" HD video conversation with a health care professional if marketed as a general purpose IT product.
- Mobile apps that monitor a consumer's use of the mHealth system for billing purposes.

E. Process for determining whether a mobile app is regulated

FDA recommends the following approach to determine whether a particular mobile app is a regulated mobile medical app based on its intended use claims.

The two categories of products described in section V.A require separate decision-making processes.[51] For mobile apps that involve ambiguous claims, FDA recommends the 513(g) process to determine whether a mobile app meets the definition of a medical device and if it is a regulated mobile medical app. If the mobile app is determined to be a regulated mobile medical app, FDA will generally provide the following information consist with the current 513(g) process:

1. The generic type of device (e.g., classification regulation) (if any) that applies;
2. The Class within that generic type of device (and if more than one Class within that generic type, the particular Class that applies);
3. Whether a guidance document has been issued regarding the exercise of enforcement discretion over the particular Class of devices within that generic type; and
4. Whether additional requirements apply.[52]

[51] The existing 513(g) process can resolve the ambiguous claims because the existing process allows FDA to make a determination as to whether the product is a medical device based on information provided by the manufacturer. The existing 513(g) process does not help to resolve the claims made about mobile apps that technically meet the definition of a medical device because 1) the information collected in the process is not sufficient to making the kind of judgment that needs to be made, and 2) these claims technically meet the literal definition of a medical devices and, therefore, the result of the 513(g) determination would always be that the product is regulated. FDA must be able to exercise enforcement discretion for those claims that pose little risk and for which it is in the public interest to not regulate. The additional information required to convert 513(g) into a process that covers these types of claims will likely overburden the process, making review of ambiguous claims more difficult.

[52] CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICAL EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., DRAFT GUIDANCE FOR INDUSTRY AND FDA STAFF: FDA AND INDUSTRY PROCEDURES FOR SECTION 513(G) REQUESTS FOR INFORMATION UNDER THE FEDERAL FOOD, DRUG, AND COSMETIC ACT 4 (2010), *available at*

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For mobile medical apps that the Agency determines should not be regulated based on their low risk and social benefit, FDA will generally use its authority to make product-specific determinations regarding enforcement discretion. Enforcement discretion should be based on the exemption criteria established above and, therefore, should be based on evidence that the mobile medical app meets these criteria. In addition, risk may be determined based on a "primary mode of action" approach, whereby the significance of the wellness or non-medical purposes of the product weighs in favor of enforcement discretion for products that do not clearly meet the criteria above but are sufficiently low risk to warrant the exercise of enforcement discretion. To facilitate a determination, the manufacturer should submit specific information, including:

1. A product description and concise summary of the product's uses;
2. Samples of proposed marketing materials (e.g., instructions and other reference guides);
3. Evidence that the appropriate criteria are met; and
4. A recommended determination.

FDA will generally issue a confidential letter to the manufacturer within 60 days of receipt of the request for determination.

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VI. Regulatory requirements

This guidance, including the Appendix A and existing medical device regulatory classifications in Appendix B, is intended to assist manufacturers in determining if a product is a regulated mobile medical app and FDA's expectations for that product. Additional information can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/default.htm. This section describes in greater detail the regulatory requirements applicable to regulated mobile medical apps under this guidance (as described in Section V).

A. Requirements for mobile medical device manufacturers subject to regulatory oversight

Manufacturers of regulated mobile medical apps are subject to the requirements described in the applicable device classification regulations. Depending on the classification and the associated regulation for the regulated mobile medical app, manufacturers of regulated mobile medical apps are required to follow associated controls established by the regulation.

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Class I devices: General Controls, including (as applicable):

- Establishment registration, and Medical Device listing (21 CFR Part 807);
- Quality System (QS) regulation (21 CFR Part 820);
- Labeling requirements (21 CFR Part 801);
- Medical Device Reporting (21CFR Part 803);
- Premarket notification (21CFR Part 807);

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http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM209851.pdf.

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- Reporting Corrections and Removals (21 CFR Part 806); and
- Investigational Device Exemption (IDE) requirements for clinical studies of investigational devices (21 CFR Part 812)

Class II devices: General Controls, Special Controls, and (for most Class II devices) Premarket Notification

Class III devices: General Controls and Premarket Approval (21 CFR Part 814)

Appendix C provides a brief summary of the above requirements. Additional information is available at http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/default.htm, under "Overview of Medical Device Regulation" and "How to Market Your Device." If you need further assistance, you may contact the Division of Small Manufacturers, International and Consumer Assistance: Email: dsmica@fda.hhs.gov; phone: 301-796-7100 or 800-638-2041.

B. Expectations for mobile medical app distributors

The FDA expects distributors of regulated mobile medical apps will cooperate with manufacturers in conducting corrections and removal actions. Mobile medical app manufacturers are required to make timely reports of corrections and removals made to reduce a health risk or remedy a violation of the FD&C Act that presents a health risk, and to keep records regarding other corrections and removals.[53]

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[53] 21 CFR 806.10 and 806.20.

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APPENDIX A – Examples of regulated mobile medical apps

This Appendix provides an exemplary list of functionalities to illustrate types of regulated mobile medical apps. The FDA understands that there may be other unique and innovative mobile apps that may not be covered in this list that may also constitute regulated mobile medical apps. This list is not exhaustive; it is only intended to provide clarity and assistance in identifying which mobile medical apps are regulated.

Regulated mobile medical apps that are extensions of regulated medical device for purposes of controlling the medical device or for the purpose of displaying, storing, analyzing, or transmitting patient-specific medical device data include:

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- Apps that allow the user to view medical images on a mobile platform and perform an analysis or process for diagnosis;
- Apps that connect to DICOM medical image servers and provide processing functions such as pan, zoom, measurement, auto contrasting, automatic detection of features, and other similar functionality;
- Apps that analyze, assess, or interpret electrocardiogram or electroencephalogram data;
- Apps that connect the mobile platform to vital signs monitors, bedside monitors, cardiac monitors, or other similar devices to:
    - Be used as a central viewing station for display;
    - Remotely access vital sign measurements of patients at home;
    - Be used in displaying and viewing digital images, including digital mammography, for review and analysis by trained medical practitioners;
    - Record arterial oxygen saturation and pulse rate of adult and pediatric patients inside hospitals and activate an alarm based on changes in levels;
    - Remotely review other standard or critical real-time numeric data from labor and delivery;
    - Perform remote Holter monitoring;
    - Connect to medical imaging devices for displaying, processing or storing medical images;
    - Wirelessly connect to medical devices and can relay or generate alarms;
    - Perform remote control, setting changes, or readout via wireless links such as programming or controlling a hearing aid system or implantable or body worn medical device.
- Apps that are used as patient screening tools for blood transfusion (extension of Blood Establishment Computer Software (BECS)) or other biologics;
- Apps that connect to a home use diagnostic medical device such as a blood pressure meter, body composition analyzer, or blood glucose meter to collect historical data or to receive, transmit, store, analyze, and display measurements from connected devices;
- Apps that control a blood-pressure cuff connected to a mobile platform to inflate the cuff and measure a person's blood pressure; and
- Apps that act as wireless remote controls or synchronization devices for MRI or X-

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Ray machines.

Regulated mobile medical apps that transform or make the mobile platform into a regulated medical device by using attachments or sensors or similar medical device functions:

- Apps that attach EKG/ECG leads to a mobile platform to collect/analyze/monitor EKG/ECG signals;
- Apps that connect wirelessly to a blood glucose tester to display, calculate, trend, convert, or download results to a PDA;
- Apps that generate sine signals from 125Hz to 8kHz (8 steps) to check the user's hearing;
- Apps that act as a blood glucose meter by using an attachment to a mobile platform;
- Apps that act as an electronic stethoscope by connecting (either via wire or wirelessly) to an external sensor to record, manipulate, or measure sound waves;
- Apps that use the mobile platform with or without a sound transducer (microphone) to act as an electronic stethoscope to amplify heart, lung, blood vessel, enteral, and other body sounds;
- Apps that use the built-in accelerometer or other similar sensors in a mobile platform to monitor the user's movement to determine conditions such as sleep apnea, sleep phase, fall detection, or detect motion related to other conditions or diseases or to measure heart rate;
- Apps that use the light source from a mobile platform to cure and treat specific conditions, such as acne;
- Apps that attach sensors to a mobile platform to measure blood glucose, electrocardiograph, or other similar functions;
- Apps that use a mobile platform's built in features such as light, vibrations, camera, or other similar sources to perform medical functions;
- Apps that use a mobile platform to upload electroencephalograph (EEG) recordings and automatically detect seizures;
- Apps that use a mobile platform to record response time and accuracy of patients completing a cognitive task and/or automatically score or interpret cognitive testing results;
- Apps that use pictures and sound to diagnose conditions by comparing to previously determined diagnoses of images, symptoms, sounds, or other physiological measurements; and
- Apps that use a mobile platform in determining blood donor eligibility prior to collection of blood or blood components.

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Mobile medical apps that allow the user to input patient-specific information and - *using formulae or a processing algorithm* - output a *patient-specific* result, diagnosis, or treatment recommendation that is used in clinical practice or to assist in making clinical decisions:¶
<#>Apps that perform calculations intended to be used by clinicians for automating tasks, such as:¶
<#>eGFR with CKD-Epi, Cockcroft-Gault, and MDRD;¶
<#>A-a gradient, etc.¶
<#>Apps that act as calculators or utilize algorithms to produce an index, score, scale, or other similar calculations (e.g., Glasgow Coma Scale, pain index, Apgar score, NIH stroke scale, etc.);¶
<#>Apps that calculate parameters associated with the use of radioisotopes;¶
<#>Apps that calculate the amount of chemotherapy needed based on the patient's Body Surface Area;¶
<#>Apps that assist with patient-specific dosing, e.g., radiation planning;¶
<#>Apps that calculate Warfarin Loading and Warfarin Maintenance doses for different anti-coagulation therapies based on nomograms;¶
<#>Apps that act as calculators to determine the maximum dosage of local anesthesia based on a patient's weight and age; or¶
<#>Apps that calculate Osteoporosis Risk Assessment by Composite Linear Estimate (ORACLE score).¶
<#>Apps that collect blood glucose readings and caloric intake to help manage diabetes by calculating pre-meal insulin dose (Bolus) or Basal adjustments; or¶
<#>Apps that act as a dosing calculators for a treatment regimen intended for a specific patient population (pediatrics);¶
<#>Apps that define disease stage or progression, and provide a prognosis of a medical condition or predict a patient's response to treatment based on a analysis of physiological, laboratory, and other data; or¶
<#>Apps that provide differential diagnosis tools for a clinician to systematically compare and contrast clinical findings (symptoms/ results, etc.) to arrive at possible diagnosis for a patient.¶

APPENDIX B – Examples of current regulations

This appendix provides examples of currently regulated devices, the Class according to which they are regulated, and their regulation numbers. This list is not a complete list of products and is intended only to provide clarity and assistance in identification of applicable regulations. FDA encourages mobile medical app manufacturers to search FDA's public databases, such as the medical device database for premarket cleared (510(k)) devices and product classification database, to determine the level of regulation for a given device. The databases can be accessed through the following link: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Databases/default.htm.

For more detailed list and a searchable database of medical device classifications, please visit: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD/classification.cfm.

Additional information can also be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/default.htm.

Regulation number	Medical Device	Device Class	Submission Type ID
876.1500(b)(2)	Accessories, Photographic, For Endoscope (Exclude Light Sources)	1	510(k) exempt
870.2770	Analyzer, Body Composition	2	510(k)
868.1890	Calculator, Drug Dose	2	510(k)
868.1890	Calculator, Predicted Values, Pulmonary Function	2	510(k)
868.1880	Calculator, Pulmonary Function Data	2	510(k)
868.1900	Calculator, Pulmonary Function Interpretation (Diagnostic)	2	510(k)
862.2100	Calculator/Data Processing Module, For Clinical Use	1	510(k) exempt
874.3310	Calibrator, Hearing Aid / Earphone And Analysis Systems	2	510(k)
878.4160	Camera, Cine, Microsurgical, With Audio	1	510(k) exempt
878.4160	Camera, Still, Microsurgical	1	510(k) exempt
878.4160	Camera, Television, Endoscopic, With Audio	1	510(k) exempt
870.1110	Computer, Blood-Pressure	2	510(k)
870.1425	Computer, Diagnostic, Programmable	2	510(k)
892.2020	Device, Communications, Images, Ophthalmic	1	510(k) exempt
892.2010	Device, Digital Image Storage, Radiological	1	510(k) exempt
892.2010	Device, Storage, Images, Ophthalmic	1	510(k) exempt
876.1500	Device, Telemedicine, Robotic	2	510(k)
862.2100	Digital Image, Storage And Communications, Non-Diagnostic, Laboratory Information System	1	510(k) exempt
892.2030	Digitizer, Image, Radiological	2	510(k)
892.2030	Digitizer, Images, Ophthalmic	2	510(k)
870.2800	Electrocardiograph, Ambulatory, With Analysis Algorithm	2	510(k)

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882.1400	Electroencephalograph - Automatic Event Detection Software For Full-Montage Electroencephalograph	2	510(k)
882.1400	Electroencephalograph - Burst Suppression Detection Software For Electroencephalograph	2	510(k)
882.1400	Electroencephalograph - Index-Generating Electroencephalograph Software	2	510(k)
882.1400	Electroencephalograph - Non-Normalizing Quantitative Electroencephalograph Software	2	510(k)
882.1400	Electroencephalograph - Normalizing Quantitative Electroencephalograph Software	2	510(k)
882.1400	Electroencephalograph - Source Localization Software For Electroencephalograph Or Magnetoencephalograph	2	510(k)
876.1500	Endoscopic Video Imaging System/Component, Gastroenterology Urology	2	510(k)
884.2225	Imager, Ultrasonic Obstetric-Gynecologic	2	510(k)
876.1500	Led Light Source	2	510(k)
878.4810	Light Based Over The Counter Wrinkle Reduction	2	510(k)
878.4810	Light Based Over-The-Counter Hair Removal	2	510(k)
880.6350	Light, Examination, Medical, Battery Powered	1	510(k) exempt
880.5580	Locator, Acupuncture Point	2	510(k)
870.1875(b)	Lung Sound Monitor	2	510(k)
886.5540	Magnifier, Hand-Held, Low-Vision	1	510(k) exempt
880.6315	Medication Management System, Remote	2	510(k)
884.6190	Microscope And Microscope Accessories, Reproduction, Assisted	1	510(k) exempt
868.2377	Monitor, Apnea, Home Use	2	510(k)
880.2400	Monitor, Bed Patient	1	510(k) exempt
884.2660	Monitor, Blood-Flow, Ultrasonic	2	510(k)
868.2375	Monitor, Breathing Frequency	2	510(k)
870.2300	Monitor, Cardiac (Incl. Cardiotachometer & Rate Alarm)	2	510(k)
886.1510	Monitor, Eye Movement, Diagnostic	2	510(k)
884.2660	Monitor, Fetal Doppler Ultrasound	2	510(k)
884.2730	Monitor, Heart Rate, Fetal, Non-Stress Test (Home Use)	2	510(k)
884.2660	Monitor, Heart Rate, Fetal, Ultrasonic	2	510(k)
884.2660	Monitor, Hemic Sound, Ultrasonic	2	510(k)
884.2640	Monitor, Phonocardiographic, Fetal	2	510(k)
870.2300	Monitor, Physiological, Patient(Without Arrhythmia Detection Or Alarms)	2	510(k)
870.2340	Monitor, St Segment	2	510(k)
884.2660	Monitor, Ultrasonic, Fetal	2	510(k)
884.2720	Monitor, Uterine Contraction, External (For Use In Clinic)	2	510(k)
878.4810	Over-The-Counter Powered Light Based Laser For Acne	2	510(k)
868.2550	Pneumotachometer	2	510(k)
878.4810	Powered Light Based Non-Laser Surgical Instrument	2	510(k)
870.2800	Recorder, Event, Implantable Cardiac,(Without Arrhythmia Detection)	2	510(k)
876.1725	Recorder, External, Pressure, Amplifier & Transducer	2	510(k)

890.5050	Reminder, Medication	1	510(k) exempt
880.2700	Scale, Stand-On, Patient	1	510(k) exempt
864.9175	Software, Blood Bank, Stand Alone Products	2	510(k)
886.5540	Spectacle Microscope, Low-Vision	1	510(k) exempt
868.1850	Spirometer, Monitoring (W/Wo Alarm)	2	510(k)
870.1875(b)	Stethoscope, Electronic	2	510(k)
868.1920	Stethoscope, Esophageal, With Electrical Conductors	2	510(k)
884.2900	Stethoscope, Fetal	1	510(k) exempt
876.4300	System, Alarm, Electrosurgical	2	510(k)
884.2990	System, Documentation, Breast Lesion	2	510(k)
892.2050	System, Image Processing, Radiological	2	510(k)
892.1560	System, Imaging, Optical Coherence Tomography (Oct)	2	510(k)
884.2800	System, Monitoring, For Progress Of Labor	2	510(k)
884.2740	System, Monitoring, Perinatal	2	510(k)
870.2300	System, Network And Communication, Physiological Monitors	2	510(k)
876.1500	System, Surgical, Computer Controlled Instrument	2	510(k)
864.9175	System, Test, Automated Blood Grouping And Antibody	2	510(k)
880.2910	Thermometer, Electronic, Clinical	2	510(k)
886.1930	Tonometer, Ac-Powered	2	510(k)
870.2920	Transmitters And Receivers, Electrocardiograph, Telephone	2	510(k)
870.2910	Transmitters And Receivers, Physiological Signal, Radiofrequency	2	510(k)

APPENDIX C – Brief description of regulatory requirements

This Appendix provides a high level description of some select regulatory requirements for medical devices, including regulated mobile medical apps. The FDA has additional resources and publications online that describes the requirements in detail.

1. Establishment Registration and Medical Device Listing

Under 21 CFR Part 807, manufacturers of medical devices are required to annually register their establishments[54] with FDA and provide a list of the devices they market. The registration and listing requirement is a means of keeping FDA advised of who is manufacturing devices, and of the types of devices an establishment is manufacturing. Mobile medical app manufacturers are required to register their establishments with FDA and to list[55] by identifying to FDA the regulated mobile medical apps they are marketing.

Additional information can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/RegistrationandListing/default.htm. If you need further assistance, you may contact the Division of Risk Management Operations, Regulatory Policy and Systems Branch: Email: reglist@fda.hhs.gov, phone: 301-796-7400. Assistance is also available from, Division of Small Manufacturers, International and Consumer Assistance: Email: dsmica@fda.hhs.gov phone: 301-796-7100 or 800-638-2041

2. Investigational Device Exemption (IDE) requirements

An IDE allows an investigational device to be used in a clinical study in order to collect safety and effectiveness data required to support a Premarket Approval (PMA) application or a Premarket Notification 510(k) submission to FDA. Clinical studies with devices of significant risk must be approved by FDA and by an Institutional Review Board (IRB) before the study can begin. Studies with devices of non-significant risk must be approved by the IRB only before the study can begin.

Mobile medical app manufacturers who are creating mobile apps with novel technologies are encouraged to engage in early collaboration meetings with the FDA to receive clear direction for testing and development of those devices requiring clinical investigations to support marketing.

Additional information about these meetings is described in guidance issued on February 28, 2001: "Early Collaboration Meetings Under the FDA Modernization Act (FDAMA); Final Guidance for Industry and for CDRH Staff." This document is available at

[54] Under 21 CFR 807.3(c), "*Establishment*" is defined as "a place of business under one management at one general physical location at which a device is manufactured, assembled, or otherwise processed."
[55] *See* 21 CFR part 807.

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http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073604.htm.

Further information regarding the investigational device exemption can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/InvestigationalDeviceExemptionIDE/default.htm.

3. Labeling requirements

Medical device manufacturers are required to comply with applicable labeling regulations found in 21 CFR Part 801, and Part 809 for radiological health products.

4. Premarket submission for approval or clearance

Mobile medical app manufacturers should identify the current classification covering their regulated mobile medical app. Manufacturers are required to prepare and submit to the FDA an appropriate premarket submission, as required for their device classification.

Additional information can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/RegistrationandListing/default.htm.

5. Quality System Regulation (QSR)

Mobile medical app manufacturers are required to comply with the QSR. The QSR does not prescribe in detail how a manufacturer must produce a specific device, but provides a framework for all manufacturers to develop and follow to help ensure that their products consistently meet applicable requirements and specifications. As part of this framework, mobile medical app manufacturers are required to develop requirements for their products that will result in devices that are safe and effective, and to establish methods and procedures to design, produce, and distribute their devices.

Furthermore, mobile medical app manufacturers are required, as part of the QSR (21 CFR 820.30), to appropriately verify and validate their regulated mobile medical apps along with the mobile platform to ensure safe and effective operation of the regulated mobile medical app.

Mobile medical app manufacturers are required to ensure that adequate controls and processes are in place through purchasing controls to ensure safe distribution, installation and operation of the regulated mobile medical app.

Additional information regarding the QS regulation and can be found at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/QualitySystemsRegulations/default.htm.

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6. Medical Device Reporting (MDR) (Adverse event reporting)

The Medical Device Reporting (MDR) regulation requires manufacturers and importers of medical devices to submit reports to the FDA whenever they receive or otherwise become aware of information, from any source, that reasonably suggests that a device they market may have caused or contributed to a death or serious injury, or has malfunctioned and the device or similar device that they market would be likely to cause or contribute to a reportable death or serious injury if the malfunction were to recur.[56] MDR requires medical device manufacturers to:

- Submit MDR reportable events involving their medical devices as described in 21 CFR Parts 803.10(c) and 803.50;
- Submit 5-day reports as described in 21 CFR Part 803.53;
- Submit supplemental reports as described in 21 CFR Part 803.56;
- Develop, maintain, and implement written procedures for the identification and evaluation of all medical device events to determine whether the event is MDR reportable as described in 21 CFR Part 803.17;
- Conduct an investigation of each event and evaluate the cause of the event as described in 21 CFR Part 803.50(b)(3); and
- Establish and maintain complete files for all complaints concerning adverse medical device events as described in 21 CFR Part 803.18.

The MDR report (FDA Form 3500A) must contain all the information described in 21 CFR Part 803.52 that is reasonably known to the manufacturer. Information reasonably known includes any information that:

- Can be obtained by contacting a user facility, importer, or other initial reporter;
- Is in the possession of the manufacturer; or
- Can be obtained by analysis, testing, or other evaluation of the device.

For additional instructions on how to complete the 3500A form, refer to the document titled Instructions for Completing Form FDA 3500A" at:
http://www.fda.gov/Safety/MedWatch/HowToReport/DownloadForms/ucm149238.htm

For additional guidance on the MDR regulation and the reporting requirements, refer to the document titled "Medical Device Reporting for Manufacturers" at:
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm094529.htm.

[56] See 21 CFR part 803.

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For Questions about Medical Device Reporting, including interpretation of MDR policy:

- Call: (301) 796-6670 (voice)
- Email: RSMB@fda.hhs.gov
- Or write to:
  - Food and Drug Administration
    Center for Devices and Radiological Health
    Reporting Systems Monitoring Branch
    10903 New Hampshire Avenue
    WO Bldg. 66, Room 3217
    Silver Spring, MD 20993-0002

7. Correcting Problems

A mobile medical app manufacturer may voluntarily take action at any time or may be requested to take action by the FDA to correct problems. Voluntary action is usually taken by device manufacturers. Examples of the types of actions that a mobile medical app manufacturer may be requested to take include, but are not limited to:

- Inspecting the device for problems;
- Repairing the device;
- Adjusting settings on the device; and
- Upgrading software to reduce risk from a "bug" or unintended response.

Under certain circumstances, FDA may initiate a request that a manufacturer address a problem with a device through other means, including by removal of the product from the market. When recommending corrective action, the FDA intends to take into account the essential role that certain mobile medical apps take as an integral part of a larger patient care system.

Reporting Corrections to FDA:

In accordance with 21 CFR 806.10, mobile medical app manufacturers are required to promptly report, within 10 working days from the time the correction is initiated, to the FDA certain actions concerning device corrections and removals for the regulated mobile medical app. Specifically, mobile medical app manufacturers are required to report to FDA any corrections made to a regulated mobile medical app to reduce a risk to health posed by the regulated mobile medical app or to remedy a violation of the FD&C Act caused by the regulated mobile medical app which may present a risk to health.

The reporting requirement does not extend to all modifications to regulated mobile medical apps. For example, mobile medical app manufacturers are exempt from reporting requirements under 21 CFR 806.1(b)[57] for certain actions that would improve the quality of a

[57] Under 21 CFR § 806.1(b), the following actions are exempt from the reporting requirements of part 806: (1) Actions taken by device manufacturers or importers to improve the performance or quality of a device but that do not reduce a risk to health posed by the device or remedy a violation of the act caused by the

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regulated mobile medical app but that would not reduce a risk to health posed by the regulated mobile medical app or remedy a violation of the FD&C Act. If there is not a "risk to health" involved, a report to FDA is not required, but the mobile medical app manufacturer must keep a record of the correction.

More information about reporting requirements under 21 CFR Part 806 is available at: http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/RecallsCorrectionsAndRemovals.

For additional general information about medical device recalls, visit: http://www.fda.gov/MedicalDevices/Safety/RecallsCorrectionsRemovals/default.htm.

device.
(2) Market withdrawals as defined in § 806.2(h).
(3) Routine servicing as defined in § 806.2(k).
(4) Stock recoveries as defined in § 806.2(l).

APPENDIX D – Additional Resources

1. Guidance for Industry and FDA Staff - Implementation of Medical Device Establishment Registration and Device Listing Requirements Established by the Food and Drug Administration Amendments Act of 2007 -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm185871.htm
2. Medical Device Reporting for Manufacturers -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm094529.htm
3. Guidance for the Submission of Premarket Notifications for Medical Image Management Devices -- (http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073721.pdf)
4. Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm089543.htm
5. Devices; Current Good Manufacturing Practice (CGMP) Final Rule; Quality System Regulation" (61 FR 52602--52662). The Quality System regulation (Title 21 Code of Federal Regulations Part 820)
6. Design Control Guidance For Medical Device Manufacturers -- http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM070642.pdf
7. General Principles of Software Validation; Final Guidance for Industry and FDA Staff -- http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM085371.pdf
8. Guidance for Industry - Cybersecurity for Networked Medical Devices Containing Off-the- Shelf (OTS) Software -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm077812.htm
9. Information for Healthcare Organizations about FDA's "Guidance for Industry: Cybersecurity for Networked Medical Devices Containing Off-The-Shelf (OTS) Software" -- http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm070634.htm
10. IEC 60601-1-4:1996, *Medical electrical equipment, Part 1: General requirements for safety, 4. Collateral Standard: Programmable electrical medical systems*. International Electrotechnical Commission, 1996.
11. IEC 62304:2006, *Medical device Software – Software life cycle processes*. International Electrotechnical Commission, 2006.
12. IEC 61508:1998, *Functional safety of electrical/electronic/programmable electronic safety- related systems.* International Electrotechnical Commission, 1998.
13. IEEE Std 1012-1986, *Software Verification and Validation Plans*, Institute for Electrical

and Electronics Engineers, 1986.

14. *IEEE Standards Collection, Software Engineering*, Institute of Electrical and Electronics Engineers, Inc., 1994. ISBN 1-55937-442-X.
15. ISO 8402:1994, *Quality management and quality assurance - Vocabulary*. International Organization for Standardization, 1994.
16. ISO 9000-3:1997, *Quality management and quality assurance standards - Part 3: Guidelines for the application of ISO 9001:1994 to the development, supply, installation and maintenance of computer software*. International Organization for Standardization, 1997.
17. ISO 9001:1994, *Quality systems - Model for quality assurance in design, development, production, installation, and servicing.* International Organization for Standardization, 1994.
18. ISO 13485:1996, *Quality systems - Medical devices - Particular requirements for the application of ISO 9001*. International Organization for Standardization, 1996.
19. ISO/IEC 12119:1994, *Information technology - Software packages - Quality requirements and testing*, Joint Technical Committee ISO/IEC JTC 1, International Organization for Standardization and International Electrotechnical Commission, 1994.
20. ISO/IEC 12207:1995, *Information technology - Software life cycle processes*, Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 7, International Organization for Standardization and International Electrotechnical Commission, 1995.
21. ISO/IEC 14598:1999, *Information technology - Software product evaluation*, Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 7, International Organization for Standardization and International Electrotechnical Commission, 1999.
22. ISO 14971-1:1998, Medical Devices - Risk Management - Part 1: Application of Risk Analysis. International Organization for Standardization, 1998.
23. The draft guidance "Radio-Frequency Wireless Technology in Medical Devices". http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm077210.htm

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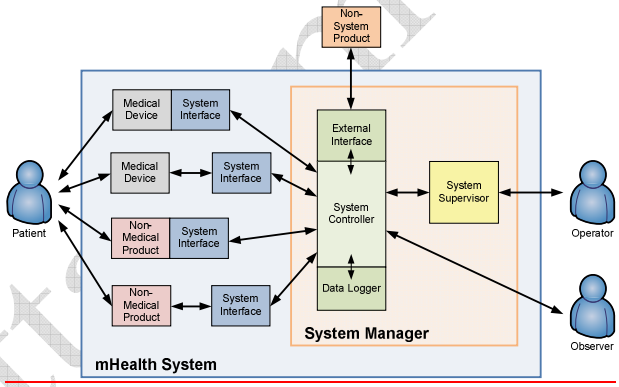
APPENDIX E – Risk Model for mHealth Systems

The following mHealth System risk model has been developed based on ASTM F-2761-2009 *Medical Devices and Medical Systems—Essential Safety Requirements for Equipment Comprising the Patient-Centric Integrated Clinical Environment (ICE)—Part 1: General Requirements and Conceptual Model* and its adaptation to connected health technologies by the Medical Device Interoperability Safety Working Group (MDISWG).[58] The fundamental premise of the mHealth System risk model is that each stand-alone product should be classified (i.e., unregulated or Class I, II, or III) based on the risk associated with that specific product. By using standard interface protocols, each product can be evaluated without identifying, at the time of the regulatory review, the numerous devices that may be included in the mHealth System. Furthermore, any product that complies with these standard interfaces can be added or replaced (by a product with equivalent functionality and intended use) without affecting the risk profile of the system.[59] This risk model applies to both hardware and software in an mHealth system. Figure 3 illustrates a generic mHealth System and the potential connections between devices, non-device products, system controllers, and system users.

Figure 3: Illustration of a Generic mHealth System and the Various Components/Interfaces



[58] The ASTM F-2761-2009 standard "establishes the general principles for the design, verification, and validation of a model-based integration system that enables the creation of an integrated clinical environment intended to facilitate cross-manufacturer medical device interoperability." The standard embraces the concepts developed in ISO 14971, IEC 60601-1, IEC 62304, and IEC 80001. The focus of the ASTM standard is "for the care of a single high acuity patient." The Medical Device Interoperability Safety Working Group (MDISWG), part of the broader Medical Device "Plug-and-Play" (MD PnP) Interoperability program, adapted the terminology and requirements of the ASTM standard for use in any interoperable health care environment. Separately, Sandy Weininger (Sr. Electrical Engineer at FDA's Center for Devices and Radiological Health) in conjunction with Michael Robkin (President, Anakena Solutions and technical lead for the NIH Quantum Grant for medical device interoperability), are working to develop a risk model for interoperable medical device systems. We are adapting the ASTM standard and MDISWG's work products for use with mHealth systems. Furthermore, we reference and support the work of Sandy and Michael as a basis for evaluating risk in an interoperable mHealth system.

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1. General Risk Assessment

Generally, the level of FDA regulation of medical devices is determined by the overall risk associated with the device. Overall risk is a function of inherent product risk and ambiguity in the claims terminology. Inherent product risk associated with a specific mHealth product is determined by evaluating the likelihood of an adverse event to the *patient* or *consumer* and the severity of harm from that event on the individual's well-being. Table 1 describes the generic inherent risk chart based on the following definitions of likelihood and severity.

Likelihood can be defined as:

- *Improbable:* so unlikely to occur that it can be assumed that this hazard will not occur.
- *Remote:* unlikely to occur but possible.
- *Occasional:* likely to occur sometime in the life of the product.
- *Probable:* likely to occur more than once in the life of the product.
- *Frequent:* likely to occur several times in the life of the product.

Severity can be defined as:

- *Negligible:* will not result in injury or illness to the patient or user; no damage to the user environment (e.g. physical, contamination, EMC).
- *Minor:* could result in minor injury to the patient or user; little or no damage to the user environment.
- *Moderate:* could result in moderate injury or illness to the patient or user; may cause moderate damage to the user environment.
- *Major:* could result in death or serious injury or illness to the patient or user without intervention; may cause significant damage to the user environment.
- *Catastrophic:* could result in death to more than one patient or user; may cause severe damage to the user environment.

Table 1: Relationship Between the Likelihood and Severity of Risk in an mHealth System[60]

Likelihood of Failure	Severity: Negligible	Minor	Moderate	Major	Catastrophic
Improbable	Minimum	Minimum	Minimum	Minimum	Low
Remote	Minimum	Low	Low	Low	Medium
Occasional	Minimum	Low	Medium	Medium	
Probable	Minimum	Low	Medium		
Frequent	Low	Medium			

[59] This concept extends to software modularization, discussed in Appendix F of this guidance document.

[60] For mobile medical apps and other software, a Level of Concern analysis should be applied.

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2. mHealth-Specific Risk Considerations

Influence of Product Functionality

For specific products within mHealth Systems, including regulated mobile medical apps, inherent risk may be influenced by evaluating the specific functionality of the product. The categories of functionality involved in mHealth systems include:

- *Data display:* representation of data (including alarms) generated by the various products in the system.
- *Generation of alarms:* creation of alarms based on data generated by the various products in the system.
- *Virtual control:* commands that allow control of specific products in the system by other products in the system.
- *Automatic control:* control commands automatically initiated according to pre-determined thresholds or algorithms based on data generated by the various products in the system.
- *Programming control:* clinician-established algorithms that control specific activity of any of the various products within the system.

Other Influential Factors

Additional factors that should be considered when determining the inherent risk of a specific regulated mobile medical apps include:

- Intended use of the product as demonstrated by the claims and design features;
- The level of involvement of the consumer, a caregiver, and/or a health care professional in the proper use of the product;
- The degree of data analysis performed by the product or the product's underlying system;
- The level of involvement of the product's manufacturer or a third party in communicating results of the product's function to the consumer, patient, caregiver, or health care professional;
- The degree of influence the use of the product will have on clinical decisions by a health care professional;
- The need for immediate review of the product's results; and
- The potential for significant harm associated with the product's failure.

The greater significance of these factors in the regulated mobile medical apps, the greater the inherent risk involved. Table 2 illustrates the degrees of risks for each of these risk factors.

Table 2: Risk Factors in mHealth Systems and Examples of Degrees of Risk[61]

Risk Factor	Degrees of Risk ← Less Risk		More Risk →
Intended Uses	Consumer uses	Disease-specific uses	Life-sustaining uses
User Involvement	Personal monitoring	Health care professional long-term monitoring	Health care professional acute care
Manufacturer's Role	Device Assessment	Infrastructure/service provider	Clinical evaluation
Data Analysis	Displaying data	Evaluating data via predictive algorithms	Triggering alerts/notifications
Role in Clinical Decisions	No role; personal use only	Informative; limited data points among many	Essential; only data source
Acuity of Results	Long-term monitoring only	Short-term monitoring, but not real-time	Real-time monitoring
Significance of Failure	Minimal harm	Reversible, physical injury possible	Irreparable, physical injury

One factor that influences the risk associated with a regulated mobile medical app in an mHealth system is the level of involvement of the consumer, a caregiver, and/or a health care professional in the proper use of the product. As with other medical devices, hardware and software components in an mHealth system may or may not involve human interaction or intervention. Human interaction or intervention can be categorized into three types of activities:

1. **Manual data entry** – keyed entry of data that is stored, transmitted, analyzed, or manipulated in some other way by the software;
2. **Assessment of data** – visual assessment of data stored in, received from, analyzed by, or manipulated in some other way by an mHealth system; and
3. **Manual manipulation** – electronically generated data that is manually modified prior to or to facilitate assessment of the data.

Historically, FDA has generally believed that human intervention reduces the risk associated with medical devices. Based on the advancement of technology and the common use of electronically generated data, FDA is no longer focusing on the means by which the data is generated. FDA now believes that electronically generated data involves no more inherent risk than manually-entered data. In line with this thinking, a hardware or software device that

[61] This table is not intended to describe the entire spectrum of degrees of risk for a given risk factor.

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requires, for example, manual data entry of personal health information or medical device data (e.g., a blood glucose measurement) should be viewed as having risk comparable to a similar device that automates these activities. On the other hand, an mHealth system that involves human intervention as an intermediate step (e.g., by the product's manufacturer) between data generation (manual or automatic) and assessment (e.g., by a health care professional) should be viewed as having additional risk when compared to a system that directly transmits the data to the end user.[62] An intermediate step that has no effect on the assessment (e.g., for billing purposes) should have no impact on the associated risk.

Examples of Products and the Associated Risk Categories

As described above, risk assessment for a regulated mobile medical app is dependent on a number of different factors. While it is difficult in this guidance document to evaluate risk for a specific product, the following are a number of examples that the Agency believes demonstrate varying degrees of risk. Examples of products that fall into the **low-risk category** based on these factors include:

- A regulated mobile medical app intended to reduce the risk of heart disease by the promotion of exercise and/or a well-balanced diet through health coaching advice on a smartphone.
- A regulated mobile medical app intended to reduce the risk of pregnancy-related disorders through the promotion of relaxation and stress management by playing soothing music on an MP3 player or radio.
- A regulated mobile medical app intended to enable self-monitoring of personal health or vital statistics.

Examples of products that fall into the **moderate- or high-risk category** based on these factors include:

- A regulated mobile medical app intended to alert a health care professional of deviations from prescribed exercise activity using system-analyzed data.
- A regulated mobile medical app with predictive algorithms intended for use as a weight management device to monitor congestive heart failure.

3. Risk Considerations for Exemption/Exclusion Criteria

Additional risk criteria for eligibility of the exemption/exclusion within this guidance document include:

1. The risk associated with a potential failure of a regulated mobile medical app should be sufficiently attenuated in time between the use of the product and the onset of the health-related condition such that failure of the product would not be considered to have an immediate or long-term, cumulative negative effect on the consumers' health; and
2. The regulated mobile medical app should not be used for life-sustaining purposes or to

[62] For regulated mobile medical apps that communicate information directly to the consumer, assessment of data by a health care professional prior to provision of the information to the consumer may reduce the associated risk (e.g., by modifying the behavior of the consumer who might otherwise have taken different action associated with greater risk).

diagnose or treat an immediately life-threatening condition.

APPENDIX F – Additional Considerations for Development and Regulation of Mobile Medical Apps

1. Modularization and Reusable Software in Mobile Medical Apps

It is possible—in fact, quite probable—that a single regulated mobile medical app may involve functionality that places it in more than one device classification. Under the current regulatory approach, in the event that a regulated mobile medical app involves different product types and classification categories, the highest classification would apply. Alternatively, the mobile medical app manufacturer may choose to separate these functionalities so that a single device classification is applicable. To achieve this modularization, each functionality could be marketed as separate products with the specific intended use described in one of the product types and associated classification categories. As yet another alternative, the mobile medical app manufacturer may choose to separate the app such that specific modules that fall into a lower classification or that are unregulated and unaffected by functionalities that fall into a higher classification.

While the traditional boundaries for software development are currently being broken, FDA recognizes that mobile medical apps of the future may involve modules develop from a variety of sources and based on novel architectures. In that way, the mobile medical app would be much like a system of apps that comprises a larger product.[63] For example, a regulated mobile medical app may be composed of multiple modules that are created by various manufacturers and that span a range of device classifications. Alternatively, the manufacturers may choose to independently market only specific modules rather than the entire app. These app units and subunits should be regulated based on the principles outlined in this guidance.[64]

When manufacturers employ the various software architecture standards described below, modules can be regulated independently from the rest of the app, so long as the module fits squarely within an existing classification.[65] FDA encourages the use of standard software

[63] The Agency recognizes that the term *app* may become obsolete over time. Nonetheless, the principles established in this guidance document should still apply.

[64] While portions of this guidance specify regulation at the app-level, the principles apply to any unit, subunit, or system of units. This guidance describes modularization at an app and sub-app level; however, the principles nonetheless apply at the level of a system of apps or any other unit or subunit.

[65] The FAA regulates *reusable software*, allowing for reuse of software such as a Global Positioning System (GPS). The FAA has used this approach in all types of aviation systems, including the highest risk classification. *See* FED. AVIATION ADMIN., U.S. DEP'T OF TRANSP., FAA ORDER 8110.49: SOFTWARE APPROVAL GUIDELINES 75–78 (2003), *available at* http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgOrders.nsf/0/640711b7b75dd3d486256d3c006f034f/$FILE/Order8110.49.pdf. According to FAA, if properly planned and packaged, software life cycle data (including software code) can be reused from one project to the next, with minimal rework. *Id.* at 75. For example, the software plans, requirements, design, and other software life cycle data may be approved on the original project and reused on subsequent projects. *Id.* By following similar planning and packaging methods, FDA can allow mHealth systems to reuse software modules that fit squarely within an existing classification and avoid unnecessary regulation of the entire mHealth system under the reusable module's classification.

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design principles in the development of mHealth software and system architectures. Use of standard design principles reduces inherent risk and enables modularization of discrete functions within a mobile medical app (i.e., app modules) as well as within an mHealth system that involves more than one hardware or software element. FDA believes the use of modularization principles will ensure that the entire product is not subject to unnecessary regulation.

Example of App-level Modularization

An MDDS device is an example of how data can be transmitted from one mobile app to another without affecting the regulatory status of either app. Assume for this example that App A collects medical device data within a blood pressure cuff. App A transmits the blood pressure data to a separate mobile app (App B). App A is regulated based on its intended use (i.e., Class II under 21 C.F.R § 870.1120), while App B is regulated as a Class I exempt MDDS device (assuming for the sake of this example that App B fits squarely within the MDDS rule). Even though Apps A & B communicate and share information with each other, each is regulated independently. Use of standard design principles should ensure the inherent risk associated with each app and with the communication between each app is minimized. Apps A & B in this example need not be separate products. At a minimum, there should be separation in the software architecture such that the functions are independent (see example below).

The principle presented in this example should not be limited to MDDS devices. App B in this example could be replaced with other Class I devices or unregulated devices. The modularization principle remains the same.[66]

Example of Module-level Modularization

Now consider a single mobile app that is designed using multiple sub-app modules to perform discrete functions within the app. Module A receives and stores medical device data transmitted from a Class II blood pressure cuff. For the sake of this example, assume that Module A fits squarely within the Class I MDDS regulation. Module B compiles the blood pressure data into a trend graph and displays the trend upon request. If appropriate software design principles are employed in the development of the software app (including Modules A & B), the risk that Module B will influence Module A should be low, such that Module A should be regulated under the MDDS classification regardless of the fact that Module A is packaged in a software app that also includes non-MDDS functions in Module B. Module B should be regulated based on the risk associated with its functionality and intended use.

Approaches to Software Modularization

A variety of approaches can be used to achieve modularization of software such that 1) a single

[66] It is important to note the distinction between firmware and software in relation to this principle. Firmware is the code that controls the basic functionality of a traditional medical device (e.g., controlling the timing of a pacemaker). The modularization principle is not intended to apply to firmware. Instead, this principle applies to software used, for example, in mobile apps or a store-and-forward system that involves back-end software for use by a health care professional or some third-party intermediary.

mobile app, comprised of software modules created by one or more manufacturers, can be separated into distinct device classifications based on the intended use of the discrete modules within the mobile app and 2) a single mobile app can be separated from other mobile apps not associated with the mHealth functionality (e.g., other mobile apps on a smartphone that perform non-medical functions and that are not intended to influence the mHealth system). These approaches include the use of:

1. Library standards (e.g., DLLs, COMs);
2. Privileged sections of controlled execution environments (e.g., for memory, task managing);
3. Other object-oriented programming approaches, including information hiding (i.e., protecting software components from external entities), decoupling (i.e., ensuring two separate software components are not tightly dependent on each other), and encapsulation (i.e., hiding inner workings of software component behind the public interface);
4. Harmonized standards for medical devices (e.g., IEC 62304 – for medical device software; IEC 60601 – for medical electrical equipment; IEC 61010-1 – for safety requirements for electrical equipment for measurement, control, and laboratory use; ISO 13485 – for medical device quality management systems; ISO 14971 – for medical device risk management); and
5. Defensive programming techniques (e.g., input/output validation, error handling, memory management, and data management).

When using these approaches, the manufacturer(s) should, at a minimum, design the module such that it does not affect other modules within the app/system, create reusable modules for use across all intended systems, and validate and verify the modules' performance in key scenarios.[67]

Environmental Considerations

FDA recognizes that the use of a regulated mobile medical app on a mobile platform alongside other mobile apps that are not intended to function with the mHealth system involves some additional inherent risk that platform-based functions (e.g., communication protocols) may become affected by the non-medical app. FDA believes, however, that using standard software design principles for the regulated mobile medical app with standard mobile platforms (e.g., smartphones, tablets) minimizes this risk. Compliance with ISO 14971 and the Quality System Regulation (21 C.F.R. Part 820) will further reduce this risk.

In some situations, the regulated mobile medical app and hardware are inseparable (e.g., device operating systems), while in others the regulated mobile medical app is not hardware-dependent (e.g., stand-alone software app). Where a regulated mobile medical app cannot be divorced from the hardware on which it executes, the regulated mobile medical app should take on the classification of the hardware unless the regulated mobile medical app itself would

[67] This concept is analogous to testing in the aviation industry of global positioning systems in different types of aircraft.

result in a higher classification. Where the regulated mobile medical app is not hardware-dependent, the regulated mobile medical app should be regulated separately from the underlying hardware. More specifically, a smartphone that is intended for use in the execution of a regulated mobile medical app should not by default be regulated at the same classification as the mobile app (or regulated at all) and vice versa. For example, a mobile medical app that allows the user to enter blood glucose readings and weight measurements and that transmits the data to the health care professional for monitoring of the patient's diabetes should be regulated as a Class II medical device. The smartphone on which the mobile medical app resides should not be regulated as a medical device (unless it otherwise meets the definition of a medical device).[68]

2. 8xx.9 Regulations

As with any medical device, regulated mobile medical apps that are Class I exempt from premarket notification are also subject to the 8xx.9 regulation restricting the exemption to certain types of devices.

FDA recognizes the importance of creating a long-lasting regulatory framework for medical device software, particularly regulated mobile medical apps. The rapid evolution of mobile medical apps and software system architectures poses a significant challenge. FDA intends to apply the following general principles to future technology to determine whether the technology is included in the scope of the current classifications and exemptions. A technology fits within an existing classification and any associated exemption if:

1. The new technology fits squarely within the wording of the classification regulation and any associated exemption, which was written with a focus on basic operating principles and intended uses rather than specific technology types; and
2. One of the following is true:
   a) The technology is reasonably foreseeable at the time the classification/exemption was created, as demonstrated by literature that existed at that time; or
   b) The technology advances since the creation of the classification/exemption do not create significant new risks that need to be evaluated.

One recent technological advancement that challenges the current regulatory approach is the use of cloud computing or "software services" to perform a discrete software function. Cloud computing challenges the current framework because functions that were once embedded in a single mobile app are now being "outsourced" to external servers and other platforms to take advantage of computing power and a diversity of resources. When functions (or entire apps) are outsourced to a cloud, it becomes difficult to identify where a fault may have occurred. A product that uses cloud computing would still fit within the existing classification regulation if the product remains squarely within the wording for the regulation and there are no new risks presented. Using standard software design approaches discussed for software modularization should minimize the inherent risk associated with cloud-based systems. More specifically,

[68] Recall that, although a smartphone might not be regulated, the regulated software manufacturer would be required to validate claims of compatibility with the smartphone and comply with other guidance regarding security in software devices.

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architectural frameworks for client-server systems, the simple object access protocol (SOAP) specification, representational state transfer (REST) designs, and extensible markup language (XML)-based methods may be useful to perform certain functions (e.g., to manage/exchange data, resources, access, or security). Risk assessment should focus on software implementation approaches and design controls rather than the platform on which the regulated mobile medical app performs its functions.

Another technological advancement that challenges the current regulatory approach is the use of over-the-air (OTA) software upgrades. OTA upgrades are used to rapidly disseminate product changes. Use of OTA upgrades should not affect the classification of the regulated mobile medical app because the basic functionality of OTA upgrades is not substantially different from downloading an upgrade using traditional approaches (e.g., using a CD or DVD disk in a PC or connecting the device to the Internet via a telephone or cable modem). Some OTA product changes may be superficial (e.g., an app icon update), while others may have a significant impact on the functionality of the app (e.g., new features or patches for known software bugs). Even where OTA upgrades implement significant changes to the functionality of the app, not all changes involve the same level of risk. For example, an upgrade that affects a software module that does not perform a medical device function (e.g., a billing module) may involve a substantial change, but may not involve any risk to the medical modules within the app. Modularization approaches described above should be used to mitigate any risk to software modules that perform medical functions. Whether a product that uses OTA upgrades remains in an existing classification regulation will depend on the risk (i.e., whether the associated risks go beyond the scope of the generic device type). Ultimately, a mobile medical app manufacturer must still comply with all applicable regulations, including design controls under the Quality System Regulations.[69]

[69] *See* 21 C.F.R. § 820.30.

APPENDIX G – Glossary

Accessory: A finished medical device that is distributed separately but intended to be attached to or used in conjunction with another finished medical device.[70]

Caregiver: An individual who is not a health care professional but who provides personal care for another individual. An example of a caregiver is a family member or professional health educator (e.g., lifestyle/health coach or educator). An individual who would otherwise be considered a health care professional may also be a caregiver if the individual is acting in a caregiver-capacity.

Cloud Computing: Cloud computing is the use of distributed and/or virtual computing platforms to perform specific analytical or administrative functions. The term "software as a service" is often used to describe software programs that are hosted and/or performed in the "cloud" (i.e., the network of distributed computing platforms).

Component: A component is a product (finished or unfinished) that is intended to be purchased by the manufacturer of the finished device in which the product will be incorporated.[71] A component is distinguished from an accessory based on the purchaser of the product—an end-user buys an accessory, while a manufacturer buys a component.[72]

Consumer: A consumer is an individual who is not diagnosed or being treated for an illness by a health care professional through the mHealth product. Examples of a consumer include an individual who utilizes a medical device for personal use or who obtains specific wellness advice from a caregiver.

Disease: For purposes of this guidance, a disease is damage to an organ, part, structure, or system of the body such that it does not function properly (e.g., cardiovascular disease), or a state of health leading to such dysfunction (e.g., hypertension). Behavioral activities (e.g., general lack of exercise or poor nutritional habits) are not included in this definition.

Disease Claim: A disease claim is any claim, not including a health claim, made on the label

[70] CTR. FOR DEVICES & RADIOLOGICAL HEALTH, FOOD & DRUG ADMIN., PUB. NO. FDA 97-4179, MEDICAL DEVICE QUALITY SYSTEMS MANUAL: A SMALL ENTITY COMPLIANCE GUIDE (1996), *available at* http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/QualitySystemsRegulations/MedicalDeviceQualitySystemsManual/default.htm.

[71] 21 C.F.R. § 820.3(c).

[72] In some cases, a component that is sold directly to an end user as a replacement part is regulated as a finished medical device. *See, e.g.*, 21 C.F.R. § 890.3920 (designating wheelchair components sold as replacement parts as Class I devices).

or in labeling of a product that demonstrates, expressly or impliedly, that the intended use of the product is to diagnose, treat, or prevent a disease.

Electronic Health Record (EHR): An EHR is an electronic record of health-related information for a patient that contains information captured from a variety of sources (e.g., during clinical visits from various health care professionals), including vital statistics, lab and imaging studies, and other information important to the patient's medical history.

Electronic Medical Record (EMR): An EMR is an electronic record of health-related information used exclusively by one or more health care providers (e.g., hospital or ambulatory care facility) as the legal record of a patient's health information.

Firmware: Firmware is fixed, embedded programs and/or data structures that internally control the proper functioning of a hardware device.

General Purpose Article: A general purpose article is a product that is not labeled or promoted for medical uses but which, by virtue of its application in health care, meets the definition of a medical device. These products either pose little or no risk, or are appropriately the sole responsibility of the health care professionals who have used them in medical applications. Examples of a general purpose article include a personal computer that has been programmed by a clinical chemist to display values from tests on human specimens; and a database management system, with no medical claims, that is used by a health care professional to identify patients at risk for a given medical procedure.[73] A general purpose article may also include a software application design for home-use by a caregiver to record medical information.

Generally Recognized Health Claim: A generally recognized health claim is a health claim for which there is general recognition, among qualified experts, that the product has been adequately shown to be safe under the conditions of its intended use. The source of evidence to support a claim of general recognition may include current, published, authoritative support from certain federal scientific bodies (e.g., NIH, CDC, the Surgeon General), the National Academy of Sciences, the American Medical Association, or other similar professional organization.

Health Care Professional: A health care professional is a physician or other medical professional 1) who is licensed under State law to prescribe drugs or devices,[74] or 2) whose primary purpose is to examine, evaluate, and treat or refer patients for examination, evaluation, or treatment by another physician or medical professional.

[73] CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., DRAFT POLICY FOR THE REGULATION OF COMPUTER PRODUCTS 2 (1989); *see also* 21 C.F.R. § 807.65(c).

[74] *See* 21 C.F.R. § 99.3 (defining *health care practitioner* for purposes of dissemination of information on unapproved uses for marketed drugs, biologics, and devices).

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Examples of a health care professional include medical doctors, dentists, chiropractors, optometrists, nurse practitioners, case managers, school nurses, and veterinarians.[75] A health care professional acts in his or her professional capacity when the individual examines, evaluates, or treats (or refers for examination, evaluation, or treatment of) an individual for a specific disease or medical condition.

Health Claim: A health claim is any claim made on the label or in labeling of a product that expressly or impliedly characterizes the relationship of the product to a disease or health-related condition. Implied health claims include third-party references, written statements (e.g., a brand name including a term such as "heart"), symbols (e.g., a heart symbol or •), or other forms of communication that suggest, within the context in which they are presented, that a relationship exists between the mHealth product and a disease or health-related condition.

Level of Concern: Level of concern refers to an estimate of the severity of injury that a device could permit or inflict, either directly or indirectly, on a patient or operator as a result of device failures, design flaws, or simply by virtue of employing the device for its intended use. Level of Concern is not related to device classification (Class I, II or III) or to hazard or risk analysis per se.[76]

Medical Advice: Medical advice is a health-related recommendation that is provided to a patient by a health care professional in furtherance of an examination, evaluation, or treatment of the patient.

Medical Device: A medical device (or device) is "an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including any component, part, or accessory, which is . . . intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or . . . intended to affect the structure or any function of the body of man or other animals, and which does not achieve its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of its primary intended purposes."[77]

[75] *See* 21 C.F.R. § 803.3 (defining *physician's office* in the medical device reporting context).

[76] CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., GUIDANCE FOR THE CONTENT OF PREMARKET SUBMISSIONS FOR SOFTWARE CONTAINED IN MEDICAL DEVICES 4–8 (2005), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm089593.pdf; *see also* CTR. FOR DEVICES & RADIOLOGICAL HEALTH, U.S. FOOD & DRUG ADMIN., GUIDANCE FOR INDUSTRY, FDA REVIEWERS AND COMPLIANCE ON OFF-THE-SHELF SOFTWARE USE IN MEDICAL DEVICES (1999), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073779.pdf.

[77] Food, Drug, and Cosmetic Act, § 201(h), 21 U.S.C. § 321(h).

Medical Device Data: Medical device data are any information generated from a medical device or manually entered into a medical device for use or analysis by the medical device.

Medical Data: Medical data are any patient-specific information generated as a result of a medical examination, evaluation, or treatment ordered or conducted by a health care professional.

Parent device: A parent device is a finished device to which an accessory is attached or with which an accessory is used (e.g., via wireless communication).

Patient: A patient is an individual who seeks the assistance of a health care professional for the examination, evaluation, or treatment of a disease or health-related condition.

Personal Health Record (PHR): A PHR is an electronic record of health information that is maintained, controlled, and shared by a consumer. A PHR consists of health-related data that are generated and entered by the consumer and can incorporate data from both EMRs and EHRs.

Software: Software is programming code (e.g., instructions or machine commands) that employs a machine or multiple machines, any of which can be real or virtual, to perform certain analytical tasks not specifically traceable to the operation of any particular physical product. Software is inherently non-physical in nature. Common terms include "software", "software application", "software app", "software program", "app", or "program". Examples include stand-alone programs for use on a computer or mobile phone, including mobile apps; web-based applications; programs that perform functions on multiple machines (e.g., "cloud computing"); and modularized, third-party software that performs discrete functions (e.g., "software-as-a-service").

Software manufacturer: A software manufacturer is any person or entity who creates, designs, develops, labels, re-labels, remanufactures, or modifies software or who creates a software system from multiple components, including someone who might commonly be called a "software developer". In addition, anyone who initiates specifications or requirements for software or who procures product development/manufacturing services from other individuals or entities for subsequent commercial distribution is a software manufacturer. This term does not include a person or entity who solely distributes or markets software or who provides a service for others to distribute or market software on the Internet.

Software module: A software module is a discrete element of a software application that performs a specific function upon request by the core software code or by another software module. Software modules are used as part of a software architecture as a means of partitioning specific sub-functions that, when combined in a larger package or "wrapper", create the software application. The specific functions performed by a

software module can be analytical (e.g., calculating daily averages of medical device data) as well as procedural (e.g., using standard or proprietary protocols for transmitting and/or converting data streams).

Wellness Data: Wellness data are consumer-specific, health-related information. Examples of wellness data include health information that is not medical data or that is generated by a consumer and/or a caregiver.

Wellness Advice: Wellness advice is a health-related recommendation that is provided via any mechanism to a consumer by a caregiver or by an individual who is not a health care professional acting in their professional capacity. An example of wellness advice is a recommendation by a person or company via a software or web-based program to increase exercise activity or reduce calorie consumption.

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This guidance is limited only to mobile medical apps. The following examples represent mobile apps that FDA does **not** consider to be mobile medical apps for purposes of this guidance:

Mobile apps that are electronic "copies" of medical textbooks, teaching aids or reference materials, or are solely used to provide clinicians with training or reinforce training previously received. These types of apps do not contain any patient-specific information, but could show examples for a specific medical specialty. Examples of such medical text books include the electronic Physician's Desk Reference and similar reference materials that are typically used as part of course instruction and are implemented as electronic books. Exemplary teaching aids and reference materials include: flash cards or quizzes that are used for training purposes or as reference material (e.g., with preloaded medical images, conditions, pictures, graphs, etc.); slideshows of common conditions; lists of medical terminology; and review materials that are to be used by medical students during training. (In contrast, mobile apps that allow the user to input patient-specific information along with reference material to automatically diagnose a disease or condition are considered mobile medical apps).

Mobile apps that are solely used to log, record, track, evaluate, or make decisions or suggestions related to developing or maintaining general health and wellness. Such decisions, suggestions, or recommendations are **not** intended for curing, treating, seeking treatment for mitigating, or diagnosing a specific disease, disorder, patient state, or any specific, identifiable health condition. Examples of these apps include dietary tracking logs, appointment reminders, dietary suggestions based on a calorie counter, posture suggestions, exercise suggestions, or similar decision tools that generally relate to a healthy lifestyle and wellness.

Mobile apps that only automate general office operations with functionalities that include billing, inventory, appointments, or insurance transactions. Examples include: apps that determine billing codes like ICD-9 (international statistical classification of diseases); medical business accounting functions and aids that track and trend billable hours, procedures, and reminders for scheduled medical appointments or blood donation appointments; apps that automate functions such as collecting patient histories that replace paper-based entry; apps that enable insurance claims data collection and processing; and other apps that are similarly administrative in nature.

Mobile apps that are generic aids that assist users but are not commercially marketed for a specific medical indication. Examples include apps that use the mobile platform as a magnifying glass (but **not** specifically for medical purposes),[1] recording audio, note- taking, replaying audio with amplification, and other similar functionalities.

Mobile apps that perform the functionality of an electronic health record system or personal health record system.

Attachment C:

A Call for Clarity: Open Questions
on the Scope of FDA Regulation of mHealth

A Call for Clarity: Open Questions on the Scope of FDA Regulation of mHealth

A whitepaper prepared by the mHealth Regulatory Coalition

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Introduction

The mHealth Regulatory Coalition (referred to subsequently as the Coalition) is comprised of industry representatives that manufacture and distribute the fundamental hardware and software used in mHealth* systems, healthcare providers who use mHealth technologies to improve healthcare delivery, and non-profit organizations that advocate on behalf of patients and providers for the use of mHealth in the United States.

In this whitepaper, the Coalition analyzes two fundamental questions: (1) what mHealth hardware and software will the U.S. Food & Drug Administration (subsequently referred to as the FDA or the Agency) regulate and (2) if such products are regulated, in what device classification will the FDA place them? The three device classifications determine, among other things, whether a given product requires some sort of premarket clearance or approval from the FDA. The Coalition tackles these questions because, quite simply, the answers are fundamental to the business planning process and companies as well as investors need answers as soon as possible to maintain innovation.

The Coalition wrote this whitepaper after having spent nearly five months meeting internally, and with entrepreneurs and established companies alike, to learn about their mHealth business plans. Through this process, we identified the specific open questions to determine whether the FDA would regulate their products and any applicable classification. The Coalition's mission is to drive the analysis to a level of specificity that would be meaningful to the FDA.

Importantly, *this whitepaper does not attempt to solve these problems.* Rather, the Coalition focuses on defining the myriad of problems and challenges that arise when attempting to apply current FDA policies and requirements to the future landscape of mHealth technologies. The Coalition believes that both the mHealth industry and the Agency must first clearly define the issues before we can resolve them.

The goal of the mHealth Regulatory Coalition is to work with the FDA to develop and draft a guidance document that addresses the regulation of mHealth technologies, specifically identifying what aspects of mHealth are not regulated by the Agency. We believe that the development of a guidance document will bring greater clarity and predictability to the regulatory pathway for the numerous hardware and software components on which mHealth technologies rely. Through active engagement with the FDA in this process, the mHealth Regulatory Coalition—in alignment with the Agency's dual mandates—hopes to foster innovation while ensuring the safety and effectiveness of the products that will drive the future of the American healthcare system.

This whitepaper moves us one step closer to completing our goal, by ensuring a common understanding of the nature and contours of the problem. By the end of the first quarter of 2011, we intend to prepare a guidance document that proposes solutions to the questions presented here.

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* The *m* in *mHealth* is an abbreviation for *mobile* to recognize the the integration of mobile technology in healthcare today.

Structure of the Whitepaper

This whitepaper is written such that each chapter addresses a particular aspect of mHealth regulation. Chapter 1 provides an overview of the problems that developers of mHealth technologies face given the current regulatory framework. Chapters 2–4 have two primary purposes: 1) to describe our current understanding of FDA regulation of mHealth; and 2) to provide a broad industry perspective on the challenges posed by the existing regulatory environment. Specifically, the subsequent chapters discuss the following:

- **INTENDED USE:** Whether a product will be regulated as a medical device depends on the product's intended use, including any indications for use. In the mHealth area, there is sometimes a grey area between general health and wellness on the one hand and diagnosis or treatment of a disease or health condition on the other. This makes determining the intended use challenging. Chapter 2 examines current requirements and interpretations surrounding "intended use" and highlights the challenges by considering several examples of connected devices that can serve medical or wellness purposes, sometimes simultaneously.

- **mHEALTH COMPONENT CONFIGURATIONS AND THE DEVICE-ACCESSORY CONNECTION:** Chapter 3 examines the implications of the FDA's device accessory classification policy as applied to mHealth configurations. To understand this particular challenge, we discuss some of the likely interconnections used among the various components that comprise the overall mHealth system. Such components could include:

    a. Already-classified medical devices with an established medical purpose and use;
    b. Sensors, actuators, and chipset connections necessary for enabling mHealth, including direct machine-to-machine (M2M) interactions between medical devices and a data capture device worn or carried by the patient;
    c. Smartphone and Web applications (or "apps") that support medical device interaction or in some cases, that serve a medical device function themselves;
    d. Smartbooks, netbooks, tablets, and other new devices used by people and potentially connected to medical devices;
    e. Handset manufacturer and home Wireless Gateways; and
    f. Network access points, carriers, and Internet-based software.

- **SOFTWARE FUNCTIONALITY:** Chapter 4 examines the FDA's current software rules and the ambiguities that arise when determining when and where software used in mHealth becomes a medical device. This could include software deployed at a body area network (BAN) or personal area network (PAN) level, software on a mobile phone or home gateway, an electronic health record (EHR)[†] with software that processes incoming medical device data, or larger clinical

[†] Throughout this whitepaper, we use the terms *electronic health record (EHR)*, *personal health record (PHR)*, and *electronic medical record (EMR)*. Elsewhere these terms are used both interchangeably and for specific purposes. It is important to recognize that these three terms have distinct meanings. An EMR is used exclusively by a single healthcare provider (e.g., hospital or ambulatory care facility) as the legal record of a patient's health information. An EHR is an amalgamation of data sourced from EMRs from a patient's various healthcare providers. A PHR consists of patient data that are generated and

decision support software running remotely and accessed through a network connection using data collected from mHealth devices.

Everyone—including the FDA—wants to see innovation in mHealth. To see 1,000 ideas blossom, however, industry needs some clarity regarding the scope of the FDA's requirements going forward in each of these areas. Business people simply have to know whether compliance with the FDA regulations needs to be part of their plan. Clarity and predictability are critical to continued innovation in mHealth. The FDA has previously announced that it is working on its own guidance document to offer some general advice on how mHealth apps are regulated, including what needs to be in a premarket submission. It is difficult to predict when new policy will emerge from the Agency. As anyone who has followed the proposed medical device data system rule knows, it can take years. The Coalition's hope is that the FDA will find this whitepaper useful in moving that process along.

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entered by the patient and can incorporate data from both EMRs and EHRs. We use these terms in accordance with the definitions above.

Executive Summary

This whitepaper outlines the myriad of specific questions that underlie two fundamental questions: (1) what mHealth hardware and software will the U.S. Food & Drug Administration (FDA) regulate and (2) if such products are regulated, in what device classification will the FDA place them?

Many of the questions arise because certain FDA policies were written decades ago at a time when our understanding of the connections between lifestyle and disease were not well-understood. This is not the first time the FDA has confronted such a challenge. In the early 1990s when scientists began to understand better the connections between dietary supplements and health, initially the FDA tried to regulate those supplements as drugs. At the time, the FDA's policies required that any health claims associated with ingested products triggered drug status. Fortunately, Congress and the FDA came up with a more nuanced regulatory solution that allowed dietary supplements to be brought to market without filing a new drug application.

A very significant number of mHealth products appear designed to help consumers make better choices in their lifestyles, thereby promoting healthy living. mHealth creates a connection that gives people better access to useful information when they need it wherever they are—where they live, where they work and where they play. That access to information allows consumers to take more control of their lives and make better decisions on such things as diet, exercise and avoiding conditions that stress their health. Just as with dietary supplements, it must be recognized that this new knowledge of connections between lifestyle and health should not cause innovative, low risk products to become over-regulated.

At a high-level, the Coalition's whitepaper focuses on questions that arise in three areas:

1. To what extent can mHealth-related products be excluded from FDA regulation by focusing their marketing campaigns on general improvements to consumer wellness, as opposed to focusing on the management or treatment of diseases such as diabetes and hypertension? For example, would the hardware and software associated with a system promoted for periodic transmission of a consumer's weight to his physician be a regulated medical claim or an unregulated wellness claim? What if the data are instead merely transmitted to a personal health record not associated with any particular physician? The Coalition generated a set of similar questions that all require clarification of the fine line between treatment of disease and promotion of wellness that defines FDA jurisdiction.

2. To what extent do mobile phones and other generic communication hardware become FDA regulated medical devices simply because they are promoted for connection to a medical device? Would a mobile phone manufacturer that does nothing more than passively sell through its online store a third-party app designed to connect the mobile phone to a blood glucose meter cause the mobile phone to become a regulated medical device? Would a mobile phone intended to be used to download data from a pacemaker become itself a Class III medical device and regulated to the highest degree? The FDA's so-called accessory policy that for decades has held that any product intended to be connected to a medical device is regulated to the same degree as the medical device produces some illogical scenarios if applied literally in today's connected health environment.

3. To what extent does the FDA regulate software apps that are intended to reside on mobile phones, ordinary PCs, servers or perhaps in the cloud if they function to provide connections between communication hardware and medical devices or as repositories for health data? For example, does the FDA intend to regulate personal health records? Is a software app stored on a mobile phone regulated as a medical device if it asks the patient questions and transmits the patient's answers to a health care provider? Does the FDA plan to regulate decision support software residing on a physician's mobile phone that offers a preliminary analysis of data received from the patient? Would software that sends a doctor an alert based on changes in a consumer's weight require prior clearance from the FDA? To what extent would software that the FDA intends to regulate require premarket notification? It has been years since the FDA clarified its stance on the regulation of software and today's mHealth systems heavily rely on software for a wide variety of functionality that requires clarity from the FDA on the appropriate level of regulation.

This whitepaper explains existing FDA policy in these three areas, answers at least at a high level the few questions that can be answered, and most importantly identifies the remaining open questions. This paper lays the foundation for the development of a guidance document that we plan to propose to the FDA, addressing the open questions. Basically, the Coalition first had to agree on the scope and nature of the problem to be solved, and then to suggest solutions to this problem.

Chapter 1

Charting the Future State of mHealth

The pace of change in the mHealth sector creates significant issues for policy makers and regulatory agencies as they attempt to evaluate the impact of mobile technology marketed or used for medical purposes. In the FDA context, mHealth-related technologies raise a host of pre- and post-market issues the most fundamental of which is the threshold question of which elements of the mHealth ecosystem the FDA will regulate. For that reason, this whitepaper focuses on *the scope of FDA regulation of mHealth products.*[1]

Framing the Discussion: Defining mHealth for Use in an FDA Regulatory Context

Frequently the most difficult aspect of solving a complex problem is to build a *consensus opinion of precisely what the problem is.* To that end, we propose that the definition of mHealth for FDA regulatory purposes consist of the following elements:

1. Technology architecture; and

2. Software platforms and interfaces.

Below we discuss each of these elements and then provide a comprehensive list of "in scope" and "out of scope" technologies.

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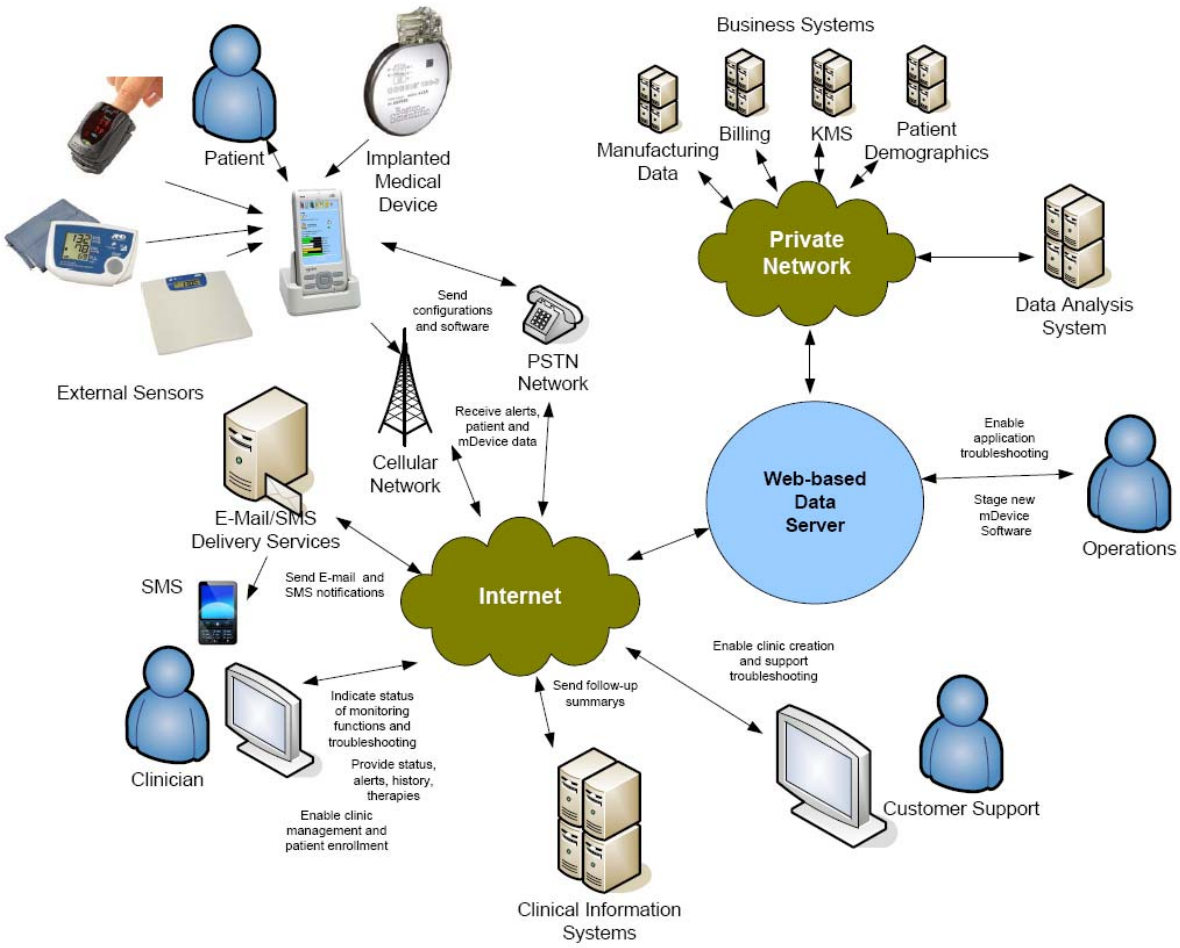
[1] There is much already written about the potential benefits and risks of using the existing and pervasive mobile phone and wireless infrastructures for healthcare purposes. In this whitepaper we attempt to avoid repeating what has already been well-documented, and instead refer readers to selected published articles and research. *See generally* ACCENTURE, INC., THE DAWN OF A NEW AGE IN HEALTHCARE: AN EARLY LOOK AT THE MARKET FOR NETWORKED DEVICES IN MHEALTH (2010), *available at* http://www.slideshare.net/3GDR/accenture-mobile-healthcare-report; DELOITTE CTR. FOR HEALTH SOLUTIONS, CONNECTED CARE: TECHNOLOGY-ENABLED CARE AT HOME (2008), *available at* http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_chs_ConnectedCare_final_0308.pdf; GSMA & MCKINSEY & COMPANY, MHEALTH: A NEW VISION FOR HEALTHCARE (2010), *available at* http://gsmworld.com/documents/mHealth_report.pdf; THE DIAGNOSIS FOR MEDICAL ELECTRONICS, EE TIMES (Dec. 2009), *available at* http://www.nxtbook.com/nxtbooks/cmp/eetimes_medelectronics_20091207/index.php?startid=58#/1/OnePage; PAUL H. KECKLEY & BIANCA CHUNG, DELOITTE CTR. FOR HEALTH SOLUTIONS, ISSUE BRIEF: THE MOBILE PERSONAL HEALTH RECORD: TECHNOLOGY-ENABLED SELF-CARE (2010), *available at* http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/Health%20Reform%20Issues%20Briefs/US_CHS_2010mPHR_091310.pdf; PWC HEALTHCARE RESEARCH INSTITUTE, HEALTHCARE UNWIRED (Sept. 2010), *available at* http://pwchealth.com/cgi-local/hregister.cgi?link=reg/healthcare-unwired.pdf; TIM SMITH & ROZ SWEENEY, NERAC, INC., FUSION TRENDS & OPPORTUNITIES: MEDICAL DEVICES AND COMMUNICATIONS (2010), *available at* http://www.nerac.com/nerac_insights.php?category=reports&id=279; BRADLEY MERRILL THOMPSON, FDA REGULATION OF MOBILE HEALTH (2010), *available at* http://mobihealthnews.com/wp-content/pdf/FDA_Regulation_of_Mobile_Health.pdf; Susannah Fox, *The Power of Mobile*, PEW INTERNET & AM. LIFE PROJECT (Sept. 13, 2010), http://www.pewinternet.org/Commentary/2010/September/The-Power-of-Mobile.aspx; Claudia Tessier, mHealth Initiative, The 12 mHealth Application Clusters (Feb. 3, 2010), http://www.scribd.com/doc/27854061/The-12-mHealth-Application-Clusters. These referenced materials are not intended to be exhaustive, but sufficiently representative.

mHealth Technology Architecture

The technology architecture of an mHealth system can be complex, but the fundamental purpose is to provide the ability to change specific components without significantly impacting the overall performance and operation of the system. As discussed below, it is the balance of complexity and flexibility that makes an mHealth system powerful. To put this discussion into context, refer to Figure 1.1 as an example of the architecture of a single mHealth system.

Figure 1.1: An Example of Connected Hardware and Software in an mHealth System[2]



This Technology Architecture has been described as having four elements for the purpose of remote patient monitoring.[3] These four key elements also apply generally to mHealth technology, as described below.

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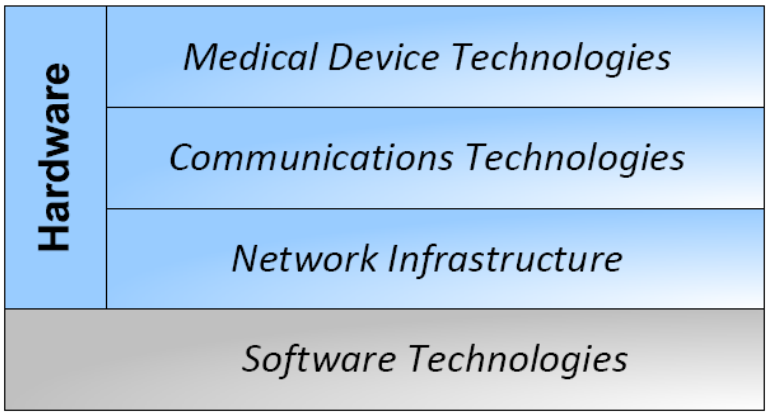
[2] Courtesy of mHealth Regulatory Coalition Member, Boston Scientific Corp.

[3] SMITH & SWEENEY, *supra* note 1 (explaining the four key elements in the context of remote patient monitoring).

Figure 1.2: The Four Key Elements of an mHealth System



As shown in Figure 1.2, these elements are:

1) Medical Device Technologies

- Approved medical devices currently in use that require "communications enablement" but otherwise are used as originally intended;
- New submitted device indications, or new devices, that have clear intended medical use under existing regulatory policy; and
- New sensors and combinations of devices that rely on close patient proximity and direct data capture from automated monitoring or directed input by the patient.

2) Communications Technologies

- Wireless transmission protocols and equipment used within and to support multiple, end-use device types including:
    - Human-machine device interaction including personal computers, mobile phones, smartphones, personal digital assistants (PDAs), tablets, the plain old telephone service (POTS, or PSTN, the Public Switched Telephone Network), and other devices with interfaces designed for human interaction;
    - Communication protocols established to enable wireless communication between devices and between devices and communications networks; and
    - Body Area Networks (BANs) or Personal Area Networks (PANs), worn on the person of the patient, that may operate in either dedicated or unlicensed spectrum bands according to FCC regulations.[4]

[4] These miniature short range networks represent an important aspect of mHealth technology innovation.

3) Network Infrastructure

- The supporting infrastructure underneath the elements of the mHealth architecture that is critical, but shared across any potential uses of mobile and wireless technology, including:
    - The Internet and its standardized protocols that enable the ability to connect devices and multiple networks together; and
    - Mobile, wireless, and fixed network infrastructure that the Internet relies on to transmit and receive data, owned and operated by large public and private network operators. These components include wireless routers, cable or digital subscriber line (DSL) modems, cellular/wireless network towers, the plain old telephone service; local area network (LAN) servers, Internet service provider (ISP) servers, data storage devices; and other devices that work in the background to enable telecommunications systems to function properly.

4) Software Technologies

- Programs or "apps" that aggregate, store, and analyze data collected by medical devices; and
- Programs or apps that facilitate the transmission of data through a network using standard or proprietary communications technologies.

This whitepaper frequently refers to these four elements in subsequent chapters.

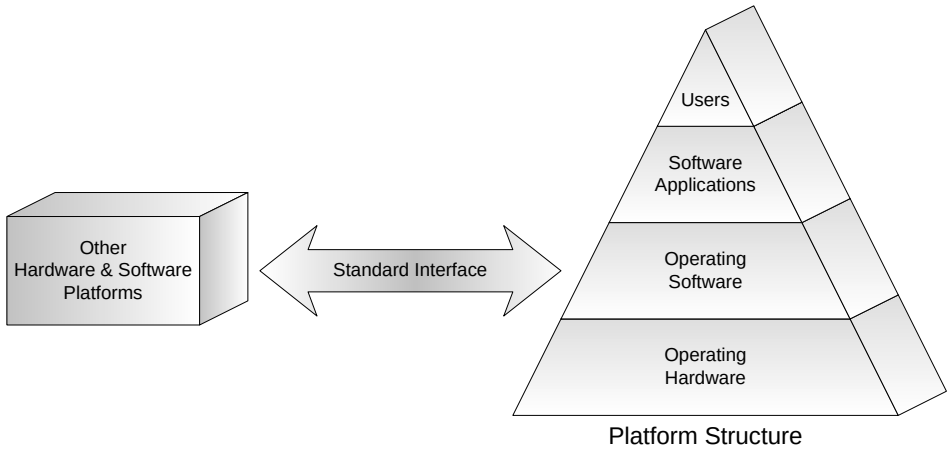
Together, Medical Device Technologies, Communications Technologies, Network Infrastructure, and Software Technologies comprise the mHealth Architecture.

Platforms and Interfaces

The second important concept of the mHealth definition is the idea of a *platform*. A platform is a combination of hardware and software that forms the fundamental structure on which other hardware and/or software function.[5] Platforms range in scope from the Internet (as a higher level platform that is accessed by familiar and standardized protocols for communication) all the way to very specific and familiar hardware devices (e.g., the iPhone) and software applications (e.g., Microsoft Windows), both of which manage direct contact with physical hardware devices and provide their own interfaces for developers and end users alike. Ultimately, a platform exists primarily through the development and adoption of software that is intended to bridge the needs and desires of developers of hardware, developers of application-specific software, and the end users of those applications and devices. Figure 1.3 provides a conceptual view of the interplay of the various elements of a platform.

[5] Some consider standard communications protocols, such as WiFi 802.11, as both a protocol and a platform, while others consider them simply as protocols. For simplicity of discussion, we will treat standard communications protocols as protocols rather than platforms.

Figure 1.3: A Conceptual Illustration of a Platform as a Component of an mHealth System



The PC and the Mac are examples of two platforms in the general computing realm. The PC has a specific hardware configuration that uses Microsoft Windows as its operating system. The Mac has a separate and unique hardware configuration that works in conjunction with the MacOS operating system. The PC and the Mac are distinct computer platforms that enable the use of other hardware and software. Standardization of hardware connections (e.g., USB 2.0 or Firewire) as well as standard wireless protocols (e.g., WiFi 802.11 or Bluetooth) allow peripheral hardware components to connect to both the PC and the Mac. Likewise, software developers (e.g., Adobe, who makes Acrobat and Photoshop) create applications that execute on both computing platforms. Unlike the standardization of hardware connections, software designed for these two platforms requires unique programming to function properly—that is, one version must be created for the PC and another for the Mac.

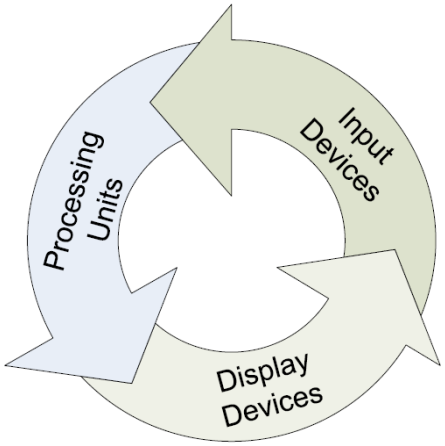
The concept of a platform already exists in the medical device industry. Pacemaker manufacturers, for example, have created unique, proprietary platforms that allow their devices to function. When a patient presents to the healthcare facility for a device checkup, the physician must use a manufacturer-specific device programmer that is designed to communicate with the patient's device. The physician must use a separate programmer when a different patient presents to the healthcare facility with a pacemaker from another manufacturer. The software that the two programmers use are unique to the manufacturer and may even be unique to the specific device as compared to other devices made by the same manufacturer (in the same way that an old PC might use Windows XP while a new PC might use Windows 7 as its operating system).

In the new and evolving mHealth realm, the use of platforms involves connecting to one or more networks, which today generally means eventually connecting to the Internet. It is through these network connections that the value of the platform increases dramatically for mHealth technology because of the ability to access new information or new web-based software services from other sources. In the same way that software adds value to a piece of hardware by expanding the functionality of the physical device, the use of network connections and interconnecting platforms adds an additional layer of functionality. This added layer moves mHealth technology from the traditional world of isolated systems with independent platforms to a "system of systems" environment where independent platforms communicate through standard protocols.

In its simplest form, an mHealth system can be viewed from the functional perspective. That is to say that the components of an mHealth system can be viewed simply as a network of interconnecting:

- Input devices (e.g., sensors, probes, etc);
- Processing units (i.e., where analysis and algorithms run); and
- Display devices (i.e., where rendering of information occurs).

Figure 1.4: Functional View of a Simplified mHealth System



In this paradigm, regulatory policy might focus on the safety of certain hardware and software elements (e.g., the inherent risk of the sensor, or the output of a particular algorithm), while the communication technologies and underlying network infrastructure can be described with parameters such as the ability to reliably (i.e., within a specific probability of error) transfer information within a certain latency period.

Even from this simplistic approach, the platform concept is integral to mHealth, as it will be impossible to determine precise configurations for testing every component and other variable across the entire spectrum of mHealth. From the previous description of the architectural layers, the potential different combinations of medical devices, communications technologies, diagnostic/analytical applications, and the underlying network infrastructure are nearly infinite.

Although platforms are not a new concept, they do represent challenges for an mHealth technology regulated as a medical device, as current device requirements were developed in a time when medical use and components were much more clearly defined, identified, and easily isolated. In contrast, the power of platforms in delivering reliable functionality, consistent user interfaces, and new applications is matched only by their ability to be fluid and malleable. Moreover, the boundaries are not always clear and may change over time.

The challenge for mHealth regulatory policy is not just embracing new technology, but new policy perspectives that account for the change from a component focus to one that is systems, platform interface, and network oriented.

Scope of mHealth Technology: Use Cases for FDA Regulatory Policy Consideration

Finally, our definition of mHealth has the following limits of scope:

Within Scope

- Ambulatory care, ongoing chronic disease care, and monitoring of discharged patients;
- Mobile connectivity, home Internet gateways, and broadband connectivity provided by non-care facilities through access points;
- Devices connected to handsets, networks, and back-end software and data storage via the Internet (i.e., "cloud" computing, if specifically used to support mHealth applications);
- Connectivity to provider electronic health records (EHRs), electronic medical records (EMRs), and personal health records (PHRs) as destinations for data generated by mHealth;
- Licensed and unlicensed spectrum;
- Sensors, BANs, PANs, and machine-to-machine (M2M) connectivity; and
- Functional architecture between mHealth components and/or nodes on the network.

Out of Scope

- Wireless systems intended primarily for use within acute care facilities such as RTLS, RFID, distributed antenna systems (DAS);
- Medical device networking, connectivity, and interoperability requirements inside an acute care facility, which are significantly different than remotely connected devices;
- Interoperability between EHR systems; and
- Technology standards selection or preference (e.g., CDMA/UMTS vs. LTE vs. WiMAX, HTML5 vs. Flash, etc).

Our working definition of mHealth is intended to enable industry and the agency to focus on a manageable scope aligned with the overall intended use of mHealth technology—to extend the boundary of care delivery beyond the four walls of a provider's facility through existing mobile and wireless networked technologies.

Conclusion

The rapid development of mHealth technologies and the diversity of the underlying components that comprise this evolving industry present a number of significant pre- and post-market questions regarding the role of the FDA in regulating this space. To promote clarity and consistency throughout this whitepaper and our future discussions with the FDA, we present a definition of mHealth and describe what is within the scope of this discussion. Specifically, we form our definition of *mHealth* around four key elements: Medical Device Technologies; Communications Technologies; Network Infrastructure; and Software Technologies.

In the chapters to follow, we elaborate on these four key elements and present the uncertainties that mHealth technologies face in light of the current legal and regulatory framework for medical devices. Our purpose is to detail the nuances of the issue and the importance of developing a guidance document specific to mHealth technology. In this way, the mHealth Regulatory Coalition intends to support the Agency's efforts to develop the appropriate guidance document that enables the FDA to fulfill its legal duty to protect and promote the public health.

Chapter 2

The Role of Intended Uses in mHealth Regulation

The "intended use" of a product is a key factor in determining whether the product is subject to FDA regulation as a medical device. Under the Food, Drug, and Cosmetic Act (the "Act"),[8] for a product to be a medical device it must be intended for a medical purpose (e.g., diagnosing or treating a disease or health condition). This chapter focuses on the particular challenges that FDA regulators, and the (potentially) regulated industry, face in evaluating the intended uses for mHealth products.

Background: Connecting Daily Activities, Wellness, and Disease Through mHealth

Often, even regulatory experts have trouble determining the intended uses of mHealth products when the product is intended for use in achieving a wellness outcome. Products for wellness are not regulated as medical devices, but it can be difficult to distinguish wellness from medical purposes. For example, a wellness product that assists in weight management (which is intended to promote general health) might be hard to distinguish from a medical device that is intended to treat obesity (which might serve the same general function, but is intended to treat a specific health condition).

Further complicating matters, mHealth products marketed by several different entities often are merged together in many different ways by different manufacturers or by consumers, for a variety of uses. The facts surrounding these interconnected uses can be complex and also play a crucial role in defining a given product's intended use.

Congress could not have reasonably contemplated these issues when it first defined *medical devices* in 1938. At that time, mHealth applications were the stuff of science fiction, not real life. The understanding of the interrelationship among daily living, wellness, and disease was not as well developed, if at all, as it is today. However, Congress did have the foresight to give the FDA authority that allows it to respond to new technologies and new challenges, within the scope of the Act, in a way that serves public health.[9]

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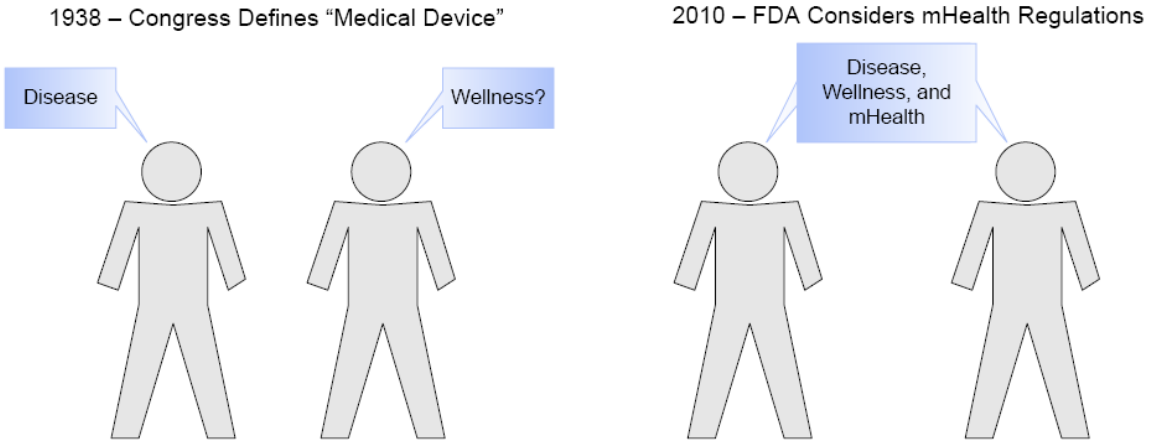
[8] 21 U.S.C. §§ 301–399a.

[9] *See* United States v. Article of Drug Bacto-Unidisk, 394 U.S. 784 (1969).

Figure 2.1: Then and Now: Disease, Wellness, and mHealth



The task ahead of us is not unlike the task the Agency faced when dietary supplements became popular. Prior to that, medical science did not have a sophisticated understanding of all of the connections between diet and health. As new dietary supplements were identified that improved overall health, there was also much discussion about their impact on specific diseases or conditions. For instance, the FDA had to grapple with the question of when a dietary supplement might, because of claims made, meet the definition of a drug. Ultimately, in that instance, Congress amended the Agency's statutory framework to allow citizens to make better and more informed use of dietary supplements to improve their health. Fortunately, in the mHealth area, we are not at the point where there is a need to modify the statutes because the FDA already has within its discretion the ability to draw appropriate lines of distinction.

Legal Framework: Intended Use

Under the Act, a product meets the statutory definition of a medical device, and thus becomes subject to FDA regulation, if it is:

> [A]n instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including any component, part, or accessory, which is . . . [either] *intended for use* in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals . . . [or] *intended to affect* the structure or any function of the body of man or other animals [i.e., "medical purposes"].[10]

The intended uses referred to in the Act are those intended by the "persons legally responsible for the labeling of devices" (for simplicity we refer to these persons as "manufacturers," although in reality the "legally responsible" person might not be the same as who actually manufactured the product).[11] Furthermore, those intended uses are evidenced by representations accompanying, and circumstances

[10] Food, Drug, and Cosmetic Act § 201(h) (emphasis added).

[11] FDA Device Labeling Guidance #G91-1, Mar. 8, 1991, *available at* http://www.fda.gov/medicaldevices/deviceregulationandguidance/guidancedocuments/ucm081368.htm.

surrounding, a product's distribution.[12] For example, a claim in a product's labeling, representation in advertising, or statement made by a sales representative could serve as evidence of intent.[13] Awareness that the product is being used for a purpose for which it is not labeled or advertised also could provide evidence of intended use.[14] Even the intent of a product's consumers might be used in evaluating the intended use of the product manufacturer.[15] Table 2.1 summarizes these sources of evidence of intended use.

Table 2.1: Sources of Evidence Considered in Evaluating a Product's Intended Use

• Product labels and labeling • Promotional labeling and advertising • Statements by the company, including those made by sales representatives, other employees, or paid consultants • Uses by other manufacturers or end consumers (with awareness of the manufacturer) • Any other evidence that bears on the objective intent of the manufacturer

Through rulemakings, guidance documents, product jurisdiction decisions, market clearances, and approvals, the FDA has given examples of various boundaries regarding intended use that, when crossed, make a product a medical device. Table 2.2 summarizes several examples.

A product that meets the legal definition of a medical device based on its intended use is subject to certain regulatory oversight by the FDA. The Agency employs a risk stratification system to categorize each medical device into Class I, II, or III—increased inherent risk of the product results in increased regulatory burden. Class III devices are subject to the highest level of scrutiny and require the greatest amount of evidence of safety and effectiveness to obtain market approval.

Although the examples in Table 2.2 provide some measure of guidance, the landscape of mHealth products and their associated intended uses reach far beyond the guidance that exists today. In the next section we illustrate challenges related to intended uses of mHealth products by posing some key questions and discussing realistic examples of mHealth technologies in use.

[12] 21 C.F.R. § 801.4.

[13] *Id.*

[14] *Id.*; United States v. Kasz Enters., Inc., 855 F. Supp. 534, 539 (D.R.I. 1994).

[15] United States v. Travia, 180 F. Supp. 2d 115, 119 (D.D.C. 2001) (citing Action on Smoking and Health v. Harris, 655 F.2d 236, 239 (D.C. Cir. 1980)).

Table 2.2: Various Declarations of Intended Use that Affect Application of Medical Device Regulations in mHealth

Product	Medical Device	***Not*** **a Medical Device**
Software	• Intended to collect data *directly* from a medical device.[16]	• Intended to allow a person to enter data manually into a computer (i.e., a person is intervening in the process, taking the data and recording it).[17]
	• Intended to store, retrieve, and display individual patient data that is collected by means other than manual entry.[18]	• Intended to perform library-type functions with information that is ***not*** patient-specific.[19]
	• Intended to assist in the remote administration of medication.[20] • Intended to analyze laboratory results and other data to provide suggestions regarding courses of treatment.[21] • Intended to "allow[] pathologists to view and analyze . . . slides from any computer via the internet [to] assist . . . in pathological diagnosis and prognosis."[22]	• Intended to perform analysis of information, or provide advice regarding, a wellness purpose.[23]
Connectors	• Intended to "facilitate[] the connection between various [medical devices]."[24]	• Intended to act as "infrastructure", allowing the exchange of information and communication between medical devices (e.g., as telephone lines, LANs, and broadband connections).[25]
Exercise Equipment	• Intended to "redevelop muscles or restore motion to joints" or for "use as an adjunct to treatment for obesity."[26]	• Intended for "general physical conditioning" or "the development of athletic abilities in individuals who lack physical impairment."[27]
Relaxation Equipment	• Intended for relaxation, but accompanied by claims of "other more specific medical or health-related indications for use" (e.g., a product "intended for use as a relaxation treatment for the reduction of stress . . . as an adjunctive treatment for high blood pressure").[28]	• Intended for "relaxation" only.[29]

[16] Proposed Rule: Devices: General Hospital and Personal Use Devices; Reclassification of Medical Device Data System, 73 Fed. Reg. 7498 (Feb. 8, 2008).
[17] *Id.*
[18] *Id.*
[19] *Id.* An example is software that allows for indexing and other library-like functions to handle general medical information (e.g., indexing the Physician's Desk Reference).
[20] 21 C.F.R. § 880.6315.
[21] FDA Warning Letter to Patrick Rambaud, President and CEO, Seryx, Inc., Feb. 22, 2007, *available at* http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2007/ucm076282.htm.
[22] FDA Warning Letter to Mohan Uttarwar, President, BioImagene, Inc., May 25, 2005, *available at* http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2005/ucm075422.htm.
[23] This has not been stated as such by FDA, but it seems to flow from the Act and its interpretation that wellness is not a medical purpose.
[24] FDA Warning Letter to Thomas R. Tribou, President, TZ Medical, Inc., Feb. 2, 2006, *available at* http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2006/ucm075787.htm.
[25] Guidance for Industry and FDA Staff: Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices, 18 (May 2005).
[26] FDA Guidance Document for the Preparation of Premarket Notification [510(k)] Applications for Exercise Equipment, 5 (July 1995).
[27] *Id.*
[28] *Id.*; K020399, Resparate Biofeedback Device (Cleared 7/2/2002); 21 C.F.R. § 882.5050.
[29] United States v. One Labeled Unit, 885 F. Supp. 1025 (E.D. Ohio 1995).

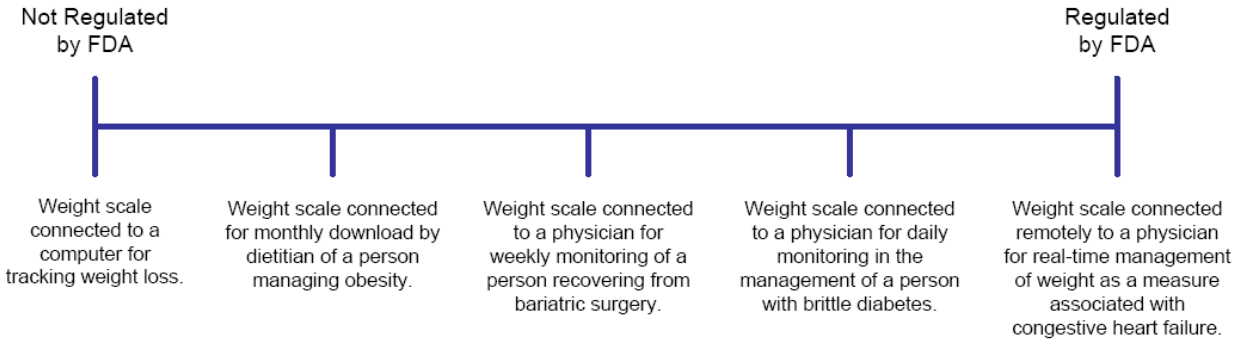
Challenges: Evaluating Intended Use in mHealth

As explained above, the central challenge in evaluating the intended use of mHealth products often arises from the way the uses of many products are deeply intertwined with *wellness*, which can be difficult to distinguish from a *medical* purpose. For example:

- The overarching question is at what point does a product cease serving a wellness function and start serving a medical purpose?
    - When does a weight management product cross the line from assisting in health conditioning to preventing or treating obesity?
    - If the dividing line used to distinguish products is based around impairment (as with exercise equipment), how is impairment defined? In the case of weight management, would the clinical definition of obesity be used, or something else?
- To what extent, and in what ways, can a manufacturer manage the scope of intended use to "wellness" through their stated claims, promotional materials, and marketing approaches?
- To what extent can manufacturers discuss the natural implications of wellness, such as reduced risks of heart disease or diabetes, without creating a medical device claim?

The difficulty in distinguishing between wellness and medical purposes is demonstrated most clearly by looking at a product that potentially serves both purposes. A weight scale, for example, may have dual wellness and medical purpose uses. How should such products be addressed? Figure 2.2 illustrates a spectrum of intended uses for a weight scale, demonstrating the grey area between regulated and unregulated products. Somewhere along the continuum, the weight scale goes from being unregulated to regulated by the FDA.

Figure 2.2: Spectrum of Intended Uses for a Weight Scale



Another challenge arises from the interconnected nature of mHealth products. Given the broad scope of evidence that can define the intended use of a product, and because use of a product can change once it has left the manufacturer's control, defining intended use can be difficult. For example, would a smartphone be considered a medical device if:

- The smartphone's manufacturer also sells medical device software to run on the phone?
- A third-party medical device software app is sold through the smartphone manufacturer's online app store?
- A third-party software developer creates a medical device app that is sold directly by the third party, without involvement of, but with the knowledge of, the phone manufacturer?
- A third-party software developer creates a medical device app that is sold directly by the third party, without the knowledge of the phone manufacturer?

The above are some of the broader questions. However, to illustrate in greater detail the potential challenges that mHealth products could face with respect to intended uses, the following real-life, fact-based scenarios demonstrate the shifting of intended use of multiple mobile technologies associated with a weight scale. For each scenario, we offer specific questions that might be raised regarding the intended use. The components common to each scenario below are:

- A digital weight scale;
- Wireless transmission of weight results for transmission via Bluetooth connectivity;
- A smartphone connected to a 3G network;
- Software to capture and transmit the results data; and
- An algorithm to trend the weight data.

In each of the scenarios, unless otherwise noted, we assume that the manufacturers promote the given use case through its advertising and other materials. In addition, consistent with the statutory requirements for medical device regulation mentioned above, the intended uses presented below are that of the *manufacturer*, rather than the intended use of the *end user*. This is an important point. The law makes it clear that intended use is determined with reference "to the objective intent of the persons legally responsible for the labeling of devices."[30]

Scenario 1: Consumer Weight Management

A manufacturer sells the mHealth system to an overweight consumer for general fitness and health improvement purposes (i.e., to lose weight). The consumer steps on the scale each day and captures his current weight. The weight measurement is transmitted via wireless connections to the consumer's mobile smartphone, which has a software app that records the data and sends it to a PHR hosted via the Internet. The app on the smartphone also trends the data and provides the consumer with a daily progress report based on the previous day's recording, indicating whether or not the consumer's weight

[30] 21 C.F.R. § 801.4

has increased or decreased. The consumer's PHR software stores all of the daily readings and provides the ability to look at the consumer's weight over a given time period.

This scenario poses a number of challenging questions, including:

- To what extent can the manufacturers of the components discuss the potential benefits of weight management to overall health (e.g., reducing the risk of certain health conditions) without suggesting the product is intended for a medical purpose?

- Assume the weight scale was sold separately from the other products, and intended for a medical purpose by its manufacturer (i.e., it was a stand-on scale classified under 21 C.F.R. § 880.2700).[31]

    - If the data collection and management products used in the above scenario were compatible with a medical device scale, and the products' manufacturers knew of the compatibility, would this be evidence of a medical purpose intended use?

    - Does the answer change if the original design was not compatible but subsequently the user is able to download a driver that enables compatibility? Does it depend on who supplies the driver or whether the manufacturers of the other products are aware of the driver's availability?

- What steps, if any, must manufacturers take if they want to ensure a product's intended uses do not grow beyond the scope of wellness?

    - Mere off-label use of a product is not sufficient to change the nature of the product from a wellness to medical purpose. In light of that, does the FDA agree there are no specific design features or labeling that the manufacturer must use to restrict the use of the product to wellness purposes?

- What influence does the PHR component have on the overall intended use? Does the manufacturer's intended use become more *medical* if the weight measurements are sent to a PHR hosted by the consumer's health insurer or health management organization as opposed to an independent Internet site?

- To what extent does the content of the daily progress report and the periodic data trending evidence a *medical* intended use?

Scenario 2: Bariatric Surgery Patient

A consumer elects to undergo bariatric surgery to address his weight problem that has now become more serious. The manufacturer sells an mHealth system that allows the patient and his physician to track the patient's post-operative progress through daily weight measurements and to determine the success of the procedure. The smartphone app remains responsible for receiving and transmitting data from the wireless weight scale to a PHR maintained by the patient. The smartphone app now has the additional responsibility of forwarding the results to the patient's primary care physician's EHR system.

[31] As discussed in the legal foundation of this chapter, products (e.g., software) that are intended to collect, transmit, and store medical data can themselves be medical devices.

This is the same physician who referred the patient to the bariatric center that performed the procedure. The primary care physician's EHR system has the ability to share the results with the bariatric surgeon via either a web portal view, or through transmission of the results. The smartphone app functionality remains the same—allowing a comparison of results on a daily basis—with the forwarding of each daily reading to the EHR systems as described.

A new app is developed and downloaded to the patient's smartphone. This new app has the ability to run an algorithm on the phone that trends the data according to set parameters, which trigger a notification to the patient's primary care physician should unusually fast weight loss occur. The parameters are defined by the physician and then the app is downloaded onto the smartphone from the handset manufacturer's app store. The app only works with the previous release of the handset software. As a result, the patient cannot upgrade the phone to the latest version of the smartphone operating system.

- The app in this scenario is developed for use by a physician for a medical purpose. Is its medical use, alone, sufficient to evidence the manufacturer's intended use?
    - What if the particular app function, which allows trending and notification, was actually intended by the manufacturer for a wellness purpose, as part of an overall health conditioning regimen (with the notification being directed to a physician, trainer, or other individual or automated system that is helping to guide conditioning)?
- Does the ability of the app to notify a physician about weight loss based on physician-defined parameters indicate that the product is a medical device?
- Would it matter if the app was promoted exclusively as an aid to help consumers manage weight as part of overall wellness with guidance from a physician or other individual, as opposed to post-operative monitoring?
- Would the fact that the app is being used for post-operative monitoring be sufficient evidence of the app manufacturer's intent to make the product a medical device?
- Assuming the app is considered a device, is selling the app through the smartphone manufacturer's app store evidence that the smartphone is intended for a medical purpose? Does the evidence of intended use change if the app is downloaded from a third party or if a third party develops the app, but the smartphone manufacturer or the wireless network carrier sells the app in its app store?
- Does the physician's ability to provide feedback or a recommendation based on the measured data demonstrate intended use? Does the intended use change if the feedback is provided via a phone call as opposed to sending a recommendation to the patient's device?

The manufacturer markets an upgraded system that allows multiple medical devices, including the weight scale, to communicate to the smartphone. Because the patient also suffers from mild hypertension and elevated blood sugar levels due to a pre-diabetic condition, the physician recommends that the patient use a blood pressure cuff and a glucometer to track improvements in blood pressure and blood sugar levels. The three devices transmit their data wirelessly to the smartphone weight management app, which now transmits three measurements to both the patient's PHR and the physician's EHR. The algorithm of the smartphone was designed only for weight measurement; therefore, the other two data sources are sent in raw, unmodified formats to the EHR system. The EHR

system contains software that is capable of trending the blood pressure and blood sugar data, combining those results with the data reported from the smartphone app, and consolidating them into a single report that tracks overall patient progression or regression, with alert triggers to notify the physician if the condition is serious enough to warrant notification.

The smartphone app's ability to collect and transmit data from products that were clearly intended to be medical devices would seem to make the app a medical device, as discussed in Table 2.2. However, a number of relevant questions remain, including:

- Does designing the smartphone in a way that allows the collection and transmission of blood pressure cuff and glucometer medical device data make the phone a medical device?

- Would the ability to create a link between the medical devices and an EHR system, with its trending and notification software, make the app or the smartphone a medical device? Does the answer change if the app/smartphone used standard technology that any number of medical and non-medical devices could use to facilitate data transmission?

- What impact does the app or smartphone manufacturers' awareness of these uses have on the determination of intended uses? What if their respective manufacturers did not promote these kinds of uses? What if they specifically disclaimed these kinds of uses?

- Could the wireless network carrier promote features of their network (e.g., coverage stability, reliability, or quality of service delivery) in the context of health data transmission and still be considered "infrastructure" that is not subject to medical device regulation?

The manufacturer also markets a system that simply records patient parameters and allows the physician to access the data for general continuity of care. Because the surgery has been deemed successful and the patient's blood pressure and blood sugar readings are no longer in elevated states that would require daily monitoring, the physician informs the patient that it is no longer necessary to use the physician's EHR system. However, the doctor encourages the patient to maintain a healthy diet and exercise regimen and to weigh himself daily. The patient uploads the information to his PHR, which has the ability to share the results with the physician as a continuity of care record (CCR). The patient asks the doctor if it would be useful to have access for the annual checkup. The doctor responds affirmatively.

- Does the patient's PHR system, which allows data sharing not specifically for a medical purpose (e.g., sharing the data with fellow dieters for support), have a different intended use if it can also be used with a CCR?

- How would the PHR or smartphone manufacturers' awareness of these uses affect the determination of intended uses for their respective product? What if the manufacturers did not promote these kinds of uses? What if they specifically disclaimed the uses?

Scenario 3: Cardiac Care Patient

Unfortunately over time, the consumer begins to notice that during the normal course of his exercise routine he feels very faint and light headed, even to the point of losing consciousness. Upon examination by his physician, the consumer is diagnosed with tachycardia, an abnormally fast and irregular heartbeat. The patient's healthcare provider determines that the individual would benefit from an implantable cardioverter defibrillator (ICD), requiring one to two days in the hospital to have the device

implanted and to conduct testing of its operation. The operation is performed and the patient is discharged from the hospital with instructions and assistance in setting up a remote monitoring system for the ICD and some associated care devices that include a blood pressure cuff, a weight scale, and a new wireless pulse oximeter.

The manufacturer of the remote monitoring system installed in the patient's home also markets a smartphone app that collects and transmits the ICD data through a wireless connection while the patient performs his normal daily activities. The data are sent directly to the central monitoring system operated by the ICD device manufacturer for subsequent analysis and sharing with the patient's physician, including transmission to the physician's EHR system. The data from the blood pressure cuff, weight scale, and pulse oximeter can be transmitted with the ICD data through the mobile phone's wireless connection. These data are synched with the patient's in-home remote monitoring device to ensure reliability and accuracy. Due to the complexity of the data and the analysis needed to be conducted, the ICD manufacturer has developed a clinical analytics and decision support software application that makes predictive assessments of the patient's condition. If threshold limits are exceeded, the analysis software notifies the cardiologist and/or primary care physician as necessary. SMS text messages can also be sent to the patient's phone to alert them of the results of the analysis conducted by the clinical decision reporting system. Results of the patient's monitoring measurements can be posted into the patient's PHR directly from the smartphone, but the ICD remote monitoring system is responsible for updating the primary care physician's and cardiologist's EHR systems. It is also available for viewing through a portal with log-in access permissions.

- Does the ability of an existing peripheral device (e.g., weight scale, blood pressure cuff, or pulse oximeter, etc.) to connect to the remote monitoring system evidence the intended use of the peripheral device manufacturer?
    - Does the answer depend on whether the peripheral device uses standard communications protocols?
    - What if the manufacturer specifically disclaims such use?
- Does the ability of the smartphone or smartphone app to transmit data from the remote patient monitoring system to the ICD manufacturer's central monitoring system evidence a *medical* intended use?

Conclusion

The scenarios presented in this chapter highlight the challenges that manufacturers face when marketing the various components of an mHealth system. Although these scenarios centered around the use of a weight scale, they represent questions that apply generally across the spectrum of mHealth systems. The intended use of a particular component may vary depending on the complexity of the system and the design features of that component. The grey area between wellness and medical purpose creates significant uncertainty as to whether a given product in a given situation will be deemed to have the intended use that implicates medical device regulation.

In the next chapter, we discuss the implications of medical device regulation on the hardware components and their connections within an mHealth system.

Chapter 3

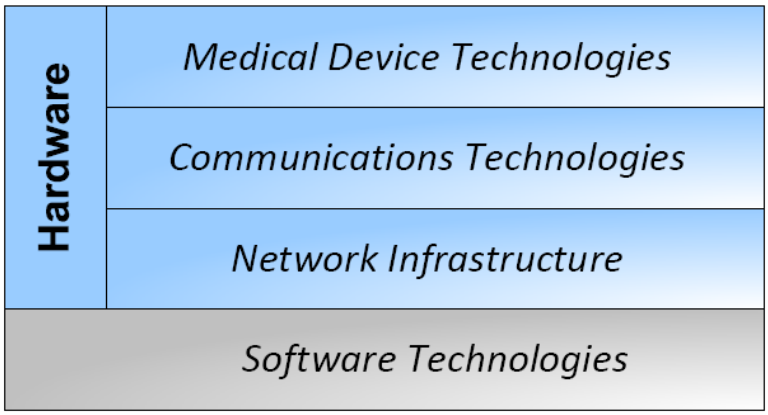
Connections Between Hardware: The "Accessory Rule" and mHealth

Connections between hardware are what puts the "mobile" in *mobile*Health (mHealth), and are what drives much of the potential value mHealth technologies offer. The potential benefits to patients from these kinds of connections range from quality of life—letting patients live their life less impeded by doctor's visits, stays in care facilities, and the like—to detecting life-threatening conditions in time to prevent serious harm to patients. If integrated into our health care system, these connections also could pay enormous dividends to the public in terms of cost savings and efficiencies in care. As explained in Chapter 1, the FDA's regulation of these products is going to be a major factor in determining how the growth and benefits of these technologies play out.

In Chapter 2 we tackled the issue of intended uses, including how a product's uses determine whether the product is a device. In this chapter we delve into how connections between and among hardware products in mHealth impact their FDA regulatory status. Here, the central regulatory question is whether a product is considered an "accessory" to another medical device, a stand-alone device that simply happens to talk to other devices, or something that plays a role in making an mHealth system work but is not regulated as a device at all.

The discussion in this chapter demonstrates the need for clarity regarding the regulation of mHealth technologies. **If we applied the accessory rule as it is currently understood, the impact could be huge and overly burdensome for the public, the FDA, and the future of mHealth technology.** In thinking about these issues, it is helpful to use the conceptual framework of the four key elements of an mHealth system that we laid out in Chapter 1 of this whitepaper. Figure 3.1 illustrates this framework.

Figure 3.1: The Four Key Elements of an mHealth System



Because we are talking about hardware here, and because software has its own special place in mHealth, this chapter focuses on connections between and among products in the **first three categories** of this framework and leaves software for Chapter 4. We also will consider the impact and role of an

element that is not a technology, but is an important part of the equation—humans, and in particular patients and healthcare providers.

Background: Hardware in mHealth

Defining Hardware

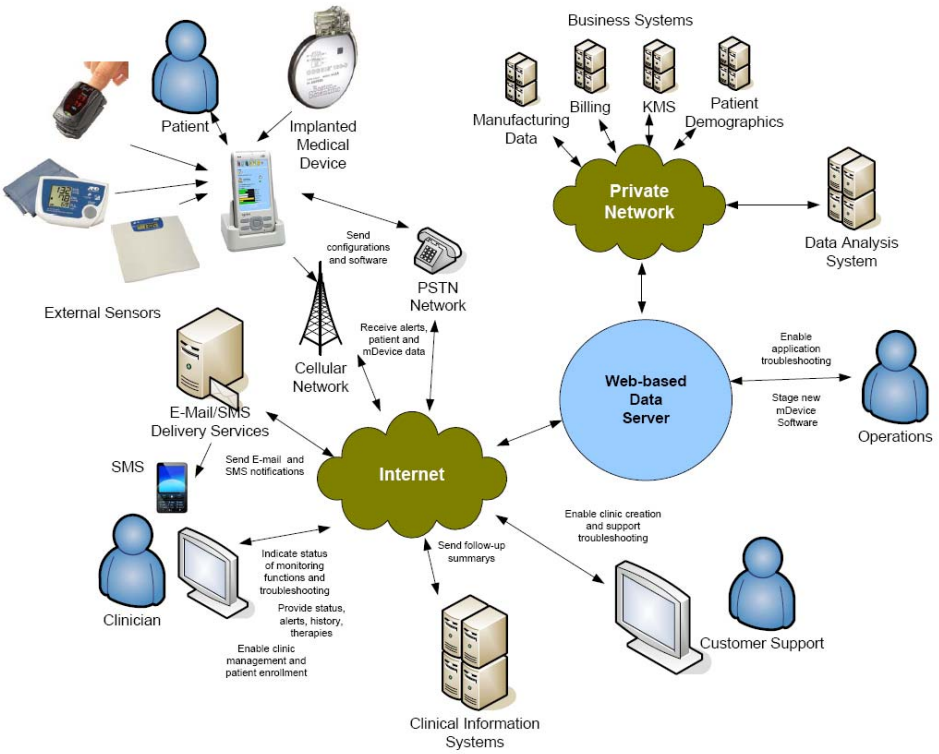
For the purposes of this whitepaper, *hardware* is defined as something physical and tangible, generally referring to electronic- and digital-based products like computers, smartphones, traditional medical devices, and the like. The key distinction is that a **physical product** is involved.

In contrast, in Chapter 4 we will deal with *software*, which we define as the instructions that make the hardware work, and as such is purely **non-physical**. Information and other data are also non-physical and thus not hardware. Importantly, for purposes of our definitions, hardware components can make use of software, but software that is not **directly associated with a specific tangible piece of hardware** is dealt with in the next chapter.

Connected Hardware

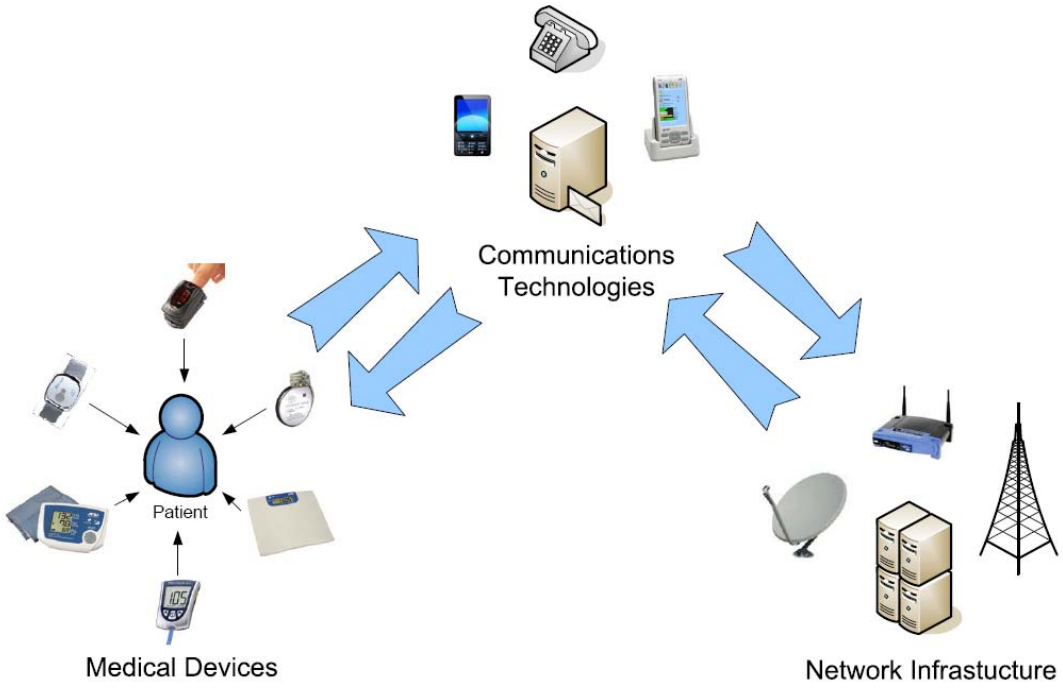
For a given mHealth system, a number of hardware and software components must function together to enable the technology to benefit its target market. Figure 3.2 illustrates a myriad of hardware and software connections that could come up in a realistic mHealth scenario. Each of the arrows in Figure 3.2 constitutes a "connection" among the various hardware and software components of an mHealth system.

Figure 3.2: An Example of Connected Hardware and Software in an mHealth System



Now let's hone in on the three hardware elements of our four-prong conceptual framework—Medical Device Technologies, Communications Technologies, and Network Infrastructure. As illustrated by Figure 3.2, each of these three key elements is an essential part of the overall scheme of this mHealth system. Each hardware component acts as a transmitter and processor of information, and each raises various regulatory issues via its connections to the others.[32] Figure 3.3 shows examples of the pieces of hardware that commonly form the basis of mHealth technologies and their respective element of the conceptual framework. Intertwined with all this is a human component—i.e., the connections mHealth technologies make between a patient and the healthcare provider.

Figure 3.3: Examples of Connected Hardware Components of an mHealth System



Below, we go through each of these elements in turn, diving into their definitions and explaining the connections that make the FDA "accessory rule" a conundrum.

Medical Device Technologies

For this whitepaper, medical device hardware includes products that are intended to diagnose and treat disease or other health conditions. These range from the very simple, like a weight scale, to the very complex, like ambulatory cardiac arrhythmia sensors or an implantable pacemaker.

[32] Although software can be described as transmitting and processing information as part of an mHealth technology, this discussion is limited to the *physical* rather than *virtual* transmission and processing of information.

With the advent of wireless telecommunications, many of these medical devices have evolved from an independent and stand-alone existence into a complex network of machines that "talk" to each other, transmitting data between devices, where before those data would have been collected and stored by a contained unit. Here are some examples of what we mean by *Medical Device Hardware*, along with some of the drivers behind integrating this element into mHealth systems:

- Mobile cardiac outpatient telemetry (MCOT) marries a standard Holter monitor (i.e., Medical Device Hardware) to a mobile phone. MCOT records a patient's electrocardiogram (ECG) and transmits the ECG data via a wireless communications network to a healthcare professional. MCOT might lead to real-time, or close to real-time, monitoring of a patient, which could provide faster help to the patient (e.g., faster diagnosis or treatment decisions).

- CardioNet's SomNet technology uses an enhanced MCOT system for remote patient evaluation and diagnosis of sleep apnea in the patient's home. This technology might motivate people to get diagnosed sooner because it eliminates the hassle of going to an overnight sleep clinic. Also, what once required buildings dedicated to sleep studies could now be brought to a patient's home, which might, in the long term, bring institutional benefits in terms of cost savings.

- The WebVMC RemoteNurse Patient Monitoring System makes use of off-the-shelf medical devices to collect blood pressure, glucose, weight, SpO2, peak flow, ECG, and other patient data, including a digital camera for visual analysis of the patient. The system uses a touch-screen display for presenting patient prompts and pre-defined questions and a hardware console to collect data from the connected medical device hardware. The system allows a healthcare provider to remotely assess patient conditions.

- Airstrip RPM is software that runs on devices capable of running Apple iPhone OS. It interfaces with third-party centralized monitoring systems that in turn gather data from patient monitors and other devices in the healthcare facility. AirStrip RPM gives healthcare providers the ability to view remotely near-real-time patient physiological data, including ECG, invasive blood pressure, non-invasive blood pressure, heart rate, pulse oximetry, and carbon dioxide.

- Boston Scientific Corporation's Latitude Patient Management combines data from multiple medical devices—an implantable pacemaker/defibrillator, blood pressure cuff, and weight scale—to enable monitoring the ICD status and certain health parameters of the patient. This technology enables a patient to maintain his or her normal daily activities and eliminates some of the face-to-face visits with healthcare professionals that would otherwise have to occur.

- BANs and PANs use sensors on, in, or near patients to facilitate monitoring of health and wellness parameters. For example, BodyMedia's FIT weight management system uses an armband sensor to measure physical activity and body temperature in order to calculate energy expenditure and employs a scale for recording weight loss or gain.

Communications Technology

Operating in the background, but crucial to creating the links between medical devices, is communications technology. This includes the wide array of machines and equipment that interact with each other for the purpose of transmitting data from point to point and ultimately to a physician or

patient, as illustrated in Figure 3.2.[33] Communications technologies might be commonly thought of as *devices*, but generally they are distinct in that the machines do not directly impact patient health—communications technology hardware helps the devices talk to one another. These kinds of products include:

- A mobile phone;
- A personal computer;
- A PDA;
- A plain old telephone; and
- A proprietary communication device.

Importantly, these products do not necessarily transmit information just between two medical devices. They might transmit to several devices and/or non-devices (e.g., hardware for medical billing systems) through a chain of communication technology, or through a web that allows the information to be transmitted to multiple products simultaneously. There is a lot more then just a cable connecting two pieces of equipment.

Importantly, these data transmissions are *virtual* in that a physical manifestation of the data may not exist. The wired and wireless protocols as well as the cellular communications employ electrical impulses and radio waves to transmit the data. It is the underlying *network infrastructure* that enables these transmissions to eventually get to the device that allows the patient or doctor to see it. This brings us to our third and final hardware category.

Network Infrastructure

Network infrastructure is an essential component of an mHealth hardware system. Without the physical components that establish the network, data transmission and patient diagnosis and treatment returns to the pre-Internet age where medical devices were isolated and often required direct clinician interaction to facilitate patient care. The network infrastructure is a combination of machines and equipment that generate, receive, interpret, and transmit information from the patient to the healthcare provider and every point in between.[34] The network infrastructure for any given mHealth system can include any combination of the following:

- A wireless router;
- A cable or DSL modem;
- A wireless or cellular tower and radio access network;

[33] In the mHealth setting, the *end user* is a patient or healthcare provider.

[34] Although the machines and equipment that compose the network infrastructure at the micro-level consist of electrical components and impulses, at the end user or macro-level, the fourth element of the mHealth technology—Software Technology—is integral to the realization of the data transmitted. These software applications that facilitate the end user to visualize the data should not be confused with software programs that execute machine commands to facilitate the transmission of information throughout the network infrastructure.

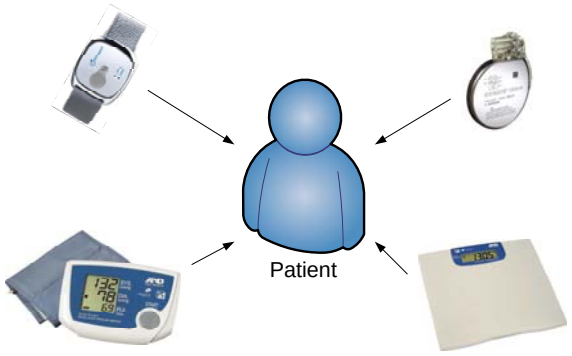
- A plain old telephone service;
- LAN servers;
- ISP servers;
- Data storage devices; and
- Other devices that work in the background to enable telecommunications systems to function properly.

In fact, it would be impossible to isolate wireless/mobile mHealth hardware completely from its wired brethren, as the mobile networks we rely on eventually connect via fiber optic cables to the Internet. Network infrastructure hardware is highly interdependent on *wired and wireless* components alike, regardless of how the end user connects to the interconnected network we call the Internet.

The Human Component

The connections that mHealth technology makes between a patient or the healthcare provider play an important role in how they are regulated. As a result, understanding the human components of a given mHealth system is critical to understanding the technology itself, as well as regulatory implications. Consider, for example, a patient (shown in Figure 3.4) with an ICD, an armband sensor for measuring body temperature and physical activity, an external blood pressure cuff, and a scale for monitoring changes in body weight.[35]

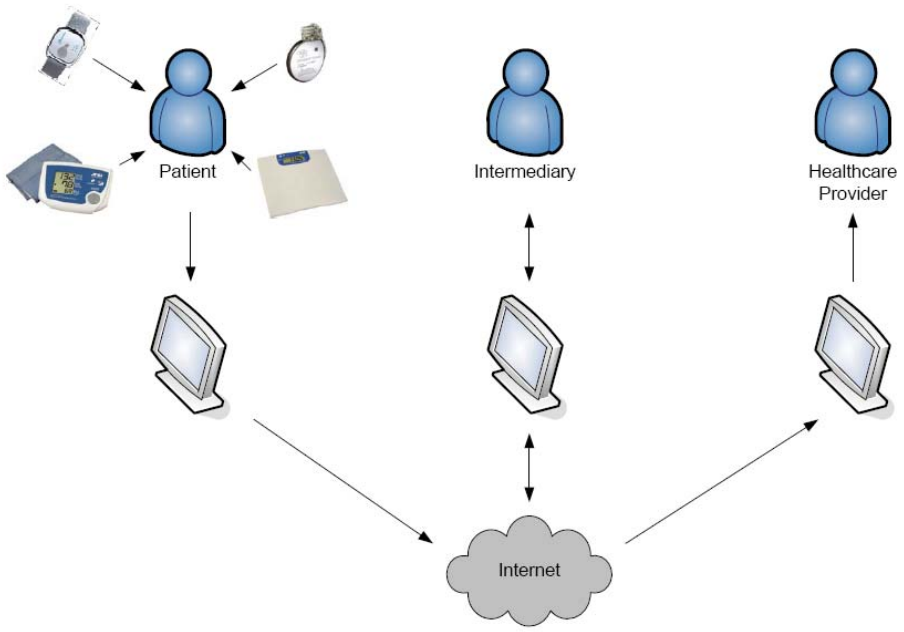
Figure 3.4: Patient-Centered Connections with mHealth Technologies



Assume none of these gadgets needs to rely on the other to function properly, yet the patient's disease management requires the use of each of the devices. The patient (or the devices themselves) may transmit the data via the Internet to a healthcare provider. Alternatively, a third-party intermediary may review the data before final transmission to the clinician, as shown in Figure 3.5.

[35] Independently, the ICD would be a Class III medical device, the armband sensor may be unregulated (depending on the intended use), the blood pressure cuff would be a Class II device, and the scale would be a Class I device (depending on the intended use). If each of these components are connected to the same patient as part of an mHealth system, the accessory rule would require that all components be regulated as a Class III medical device.

Figure 3.5: Simplified Diagram of a Generic mHealth System



This human component isolates those mHealth components with which the patient, intermediary reviewer (e.g., manufacturer's clinical staff or a clinical call center), and healthcare provider directly interact. The remaining components of an mHealth system work in the background to facilitate the flow of data throughout the system. Looking at an mHealth system from this perspective—with the human at the center—may help distinguish those elements of the system that warrant regulatory oversight from the products that merely enable mHealth to exist.

* * *

In summary, these elements of mHealth technologies are simply hardware that work in concert—via connections—to connect patients, health care providers, data, and care. The above discussion is important to understand where mHealth technologies are today and what the future holds for this rapidly evolving industry. The remainder of this chapter will focus on our existing legal framework and the challenges that it imposes on continued innovation.

Legal Framework: Accessories and Components

In the mHealth area, a large number of the regulatory issues we run up against involve the relationship between two or more pieces of hardware (one or more of which is a medical device) and how the FDA defines and controls that relationship. To get started on the legal framework relevant to these issues, under the Food, Drug, and Cosmetic Act, a product that supports (i.e., is connected to) another medical device could be:

- A medical device in its own right;
- A "component" of the medical device; or
- An "accessory" of the medical device.

Components and accessories are themselves medical devices, although the regulatory requirements for each vary significantly. Understanding the definitions and regulation of both components and accessories is important for our discussion.

Starting with the definitions, an *accessory* is a finished device that is "distributed separately but intended to be attached to or used in conjunction with another finished device," often called the *parent* device.[36] A *component*, on the other hand, is something that is "intended to be included as part of the finished, packaged, and labeled device."[37] At bottom, the difference between an accessory and a component is who buys it—end users buy accessories to use with other finished devices, while manufacturers buy components to incorporate into a finished device. Further, the accessory/component analysis turns on evaluating the item's intended use with the same approach described in Chapter 2, but with the focus turning to the issue of whether the item is intended to be attached or used in conjunction with another device, whether the item is sold directly to an end user, and when the marriage of the products is intended.

How Does FDA Regulation of Components Differ from Accessories?

First, a quick, high-level refresher on medical device classification generally. The level of regulation for a medical device is usually based on the potential risks associated with the device's intended use and its indications for use. The device's "classification" (Class I, II, or III) identifies the level of regulatory control for the device and generally identifies the marketing process the manufacturer must complete in order to obtain FDA clearance or approval for marketing.

Components, because they are intended for incorporation into a finished device, are exempt from most FDA regulatory requirements, with the regulatory burdens being borne by the finished device manufacturer who uses the component.[38] In other words, components are mostly regulated as part of the finished product they are included in, so the finished device classification (once the component is incorporated in the finished product) governs the regulation of that component.

Accessories, on the other hand, because they go right to the end user, must meet the FDA requirements applicable to them before they leave the hands of the accessory manufacturer.[39] The obvious next question is what FDA requirements apply to accessories? The answer is not always clear. From a patchwork of FDA presentations, guidance documents, our own experience, and other materials, it seems like the following basic principles usually govern accessory regulation:

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[36] CTR. FOR DEVICES & RADIOLOGICAL HEALTH, FOOD & DRUG ADMIN., HHS PUB. NO. FDA 97-4179, MEDICAL DEVICE QUALITY SYSTEMS MANUAL: A SMALL ENTITY COMPLIANCE GUIDE (Dec. 1996), *available at* http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/QualitySystemsRegulations/MedicalDeviceQualitySystemsManual/default.htm; FDA Guidance for Industry: Blood Establishment Computer System Validation in the User's Facility, 3 (Draft, Oct. 2007), *available at* http://www.fda.gov/downloads/BiologicsBloodVaccines/GuidanceComplianceRegulatoryInformation/Guidances/Blood/ucm078815.pdf.

[37] 21 C.F.R. § 820.3(c).

[38] *See, e.g.*, *id.* §§ 807.65(a), 820.1(a), .3(c), (l).

[39] *See, e.g.*, *id.* §§ 820.1(a), .3(l), .20(a)(5).

- If the product falls within its own regulatory classification, the accessory is regulated under that classification.[40]

- If the product does not fall within a regulatory classification, it is regulated as the parent device (this is sometimes referred to as the "accessory rule").[41] So, for example, if a product—even a really simple one from a technology standpoint—becomes an accessory to a Class III device, it can become subject to very onerous regulatory requirements.

- If the product has multiple parents, it is regulated with the classification of the highest classified parent.[42]

These are general guidelines. We understand the FDA is currently in the process of crafting a specific policy for mHealth apps, but that is in its early stages of development. There is some existing piecemeal guidance. For example, an Agency medical device software guidance document says that communications infrastructure, such as telephone lines and broadband connections, that allows exchange and communication between medical devices will not be regulated as medical devices.[43] However, there has not been a comprehensive statement of how potential accessories would or would not be regulated across the mHealth industry. Just as with intended uses, getting clarity about how the FDA plans to regulate these interconnected pieces of mHealth technology is something that the mHealth industry needs to foster its continued growth. And therein lie the challenges.

Challenges: Determining the Scope of the "Accessory Rule"

The fundamental challenge is this: Historically, the "accessory rule" has been thought of as an overarching rule, broadly applicable to nearly all parent device-"accessory device" connections. What are the boundaries in the mHealth world? In today's rapidly developing technological landscape, the boundaries between accessories and stand-alone devices are not always clear and may lead to regulatory requirements that are incongruent with the risk level of the product being regulated. **Indeed, if the current accessory rule were applied equally across the spectrum of mobile and wireless-enabled medical devices, mobile phones, entire cellular networks operated by carriers such as AT&T and Verizon, and even the Internet itself, could potentially be considered accessories to a device.**

A number of specific ambiguities and challenges flow from that broadly stated regulatory problem statement. Let's take the most general ones first, then work through some specific examples.

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[40] Heather Rosencrans, Director, 510(k) Staff, FDA CDRH; Presentation: 510(k) Overview, *available at* http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/ucm126288.htm.

[41] *Id.* The accessory rule is not a "rule" in the sense of an administrative rulemaking, but is merely a general policy that FDA has historically used to regulate accessories to medical devices.

[42] FDA Guidance, Content of a 510(k), *available at* http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/PremarketSubmissions/PremarketNotification510k/ucm142651.htm.

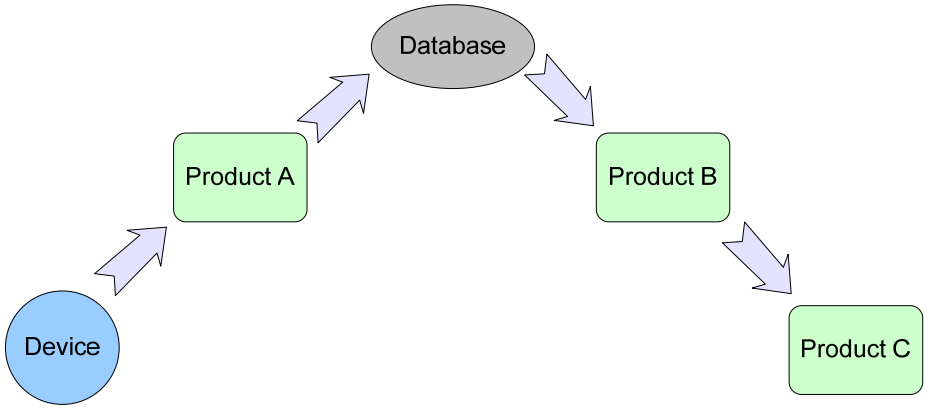
[43] Guidance for Industry and FDA Staff: Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices, 18 (May 2005).

General Questions

The primary general questions include:

- What happens to "accessories to accessories"? That is, in mHealth, there may be a configuration as shown in Figure 3.6, where Product A receives information from a Device, a Database (stored on Product B) receives information from Product A, and Product C receives information from Product B.
    - If the original parent Device means that Product A is a medical device, then does Product A render the Database a device?
        - If so, does the Database render Product B a device?
        - If so, does Product B render Product C a device?
        - If there is a break in this chain at any point, does that render the remainder of the products in the chain unregulated?
    - In any of these scenarios, how is the classification of each product determined? Does the accessory rule apply such that all products in the chain are classified as the classification of the Device?
    - Does the function of Product A, B, or C or the Database affect whether the component is regulated or, if regulated, its classification?
    - If Product A, for example, is a standard piece of hardware that can be interchanged with a number of other standard products (e.g., a DSL filter, a PSTN to cellular adapter, USB wireless network adapter/modem, etc.) based on the end user's configuration needs, is the standard product considered an accessory?
        - Does the answer depend on whether the manufacturer of the Device recommends a particular piece of hardware for Product A?
        - Does it matter if the product uses a licensed or unlicensed wireless spectrum?

Figure 3.6: Example of Potential "Accessories" to a Medical Device and Other "Accessories" in mHealth



- For specific kinds of products, the FDA has suggested that some hardware components are not regulated (e.g., network infrastructure).[44] Is this rule generally applicable to mHealth products? How do companies know when to apply it?
    - Does uploading firmware to a medical device via a public, wireless network affect regulation of the network infrastructure?
    - Is a wireless network regulated as an accessory if a medical device is embedded with a chip that enables the device to transmit data via that network directly, as opposed to transmitting the data to an intermediary product (e.g., a computer or smartphone)?
    - Does the transmission mechanism (i.e., store and forward vs. real-time) affect the regulation of the wireless network? Do the regulatory requirements change if the transmission function is part of a software app as opposed to part of the transport hardware?
- In what circumstances does an existing regulatory classification for a potential accessory override the accessory rule?
    - To take the example in Figure 3.6, what if the Device is Class III? Under the current accessory rule, Product A would be regulated as a Class III device. But if Product A is independently a Class I or II medical device under an applicable classification regulation, does the independent classification of Product A predominate such that the accessory rule does not apply?
    - Does the answer depend on intended use of Product A?
    - Does the answer depend on inherent risk of the combination of Product A with the Device?
- Sometimes whether an accessory could fall within an existing classification is not so clear, and considerable judgment needs to be exercised, particularly for Class I exempt devices that would not be submitted to the FDA. How do companies navigate these gray areas? Can companies use the *de novo* classification process for low risk devices?
- Who is responsible for reporting adverse events and for submitting post-market modification applications when a system component is updated?

The examples below further illustrate the complexity of these questions.

Example 1: A Weight Scale as Part of an mHealth System

This hypothetical product has the following system components:

- A **weight scale** to detect changes in body mass due to heart failure decompensation;

[44] *Id.*

- A **blood pressure cuff** to measure changes in blood pressure associated with changes in heart failure condition;
- An **ICD** for the detection and treatment of heart failure;
- A **proprietary communication device** that collects and transmits data from each of these components to a proprietary database located on a proprietary server network;
- Various **database access devices** (e.g., computer or smartphone) for:
    - Review of patient data by a trained clinical staff within the manufacturer's proprietary network;
    - Evaluation of patient data for billing or customer service purposes;
    - Analysis of patient data for alert notification;
    - Analysis of patient data for research and development purposes;
- A **web application server** for hosting a website that allows a healthcare provider to access the patient data; and
- A **web application access device** (e.g., computer or smartphone) for allowing a healthcare provider to access the patient data, to program alert notification settings, and/or to control device functions.

The configuration of the products above raises several questions. Even just focusing on a plain old weight scale gives a good feel for the complexity of the issues:

- Is the incredibly low risk weight scale regulated by the existing classification[45] for such sensors? Or does its direct connection with the ICD render that weight scale a Class III device, as an accessory to the ICD? Does the weight scale even fall within the accessory rule at all?
- If a device receives information from the weight scale through one or more intermediary products (e.g., a computer or smartphone), do the intermediary products shield the scale from becoming an accessory to the medical device?
    - Are the intermediary products regulated in the same classification as the parent device? If so, does that classification apply to all products in the chain (i.e., the weight scale)?
    - Would the highest classification in the chain be imputed to all the products in the chain, including those products that would otherwise not be classified as a medical device (e.g., a computer or smartphone)?
- How would the answers to the question above change if instead of going through a chain, the products were connected through a web, with the sensor transmitting to multiple products?

[45] 21 C.F.R. § 880.2700.

  - For example, instead of the weight scale sending information to a single device, the scale could also send information to a computer, a smartphone, a tablet, a web server, or any number of products that are interconnected. Do the interconnections of these products affect the regulatory classification that applies to the sensor or any other product in the web of connections?

  - To what extent is the weight scale manufacturer required to ensure the proper functionality of potential accessories and the underlying network infrastructure for each of the products in the web? For instance, if a smartphone has multiple modes of data transmission, is the smartphone an accessory such that the weight scale manufacturer must ensure proper data transmission in all possible modes of the smartphone?

- How would human intervention at some point in the process affect the application of the accessory rule, and the resulting classification?

  - For example, if the weight scale transmits data to a computer and the computer requires the patient to actively send the information (e.g., via email or the click of a button) to a healthcare provider, does this human interaction affect the relationship between the scale and the computer?

  - How do the regulatory requirements change if the human interaction is not the patient but is a trained clinician (e.g., physician, nurse, or physician assistant employed by the manufacturer) other than the patient's healthcare provider?

- To what extent does the answer to the questions above change if the information flows bi-directionally (i.e., both from the patient/device to the healthcare provider and from the healthcare provider to the patient/device)?

Example 2: A Smartphone as Part of an mHealth System

Now consider a smartphone that is used to transmit data from a medical device connected to a patient to the physician for review. (By way of illustration, recent advertisements for the iPhone 4 have shown medical applications as one of its capabilities.)

The following questions remain unanswered:

- Is the smartphone an accessory to the medical device if the phone manufacturer promotes or intends for the phone to be used as part of an mHealth system by the patient or physician?

- Is the test for determining application of the accessory rule a "one purpose" test such that if any one purpose for using the smartphone has a medical device application then the manufacturer must comply with FDA regulatory requirements? Would this require manufacturers of smartphones to design separate models of the phones—ones that work with medical products, and ones that prohibit use with medical devices?

To illustrate the complications with respect to adverse events and post-market modification issues:

- If, in the iPhone example, Apple is considered a regulated entity and the iPhone is an accessory, is Apple responsible for reporting any adverse events associated with a loss in service or a dead battery?

- A loss of service may implicate AT&T, which provides wireless communication for all iPhone users. Would AT&T become a regulated entity through application of the accessory rule for providing the underlying communication technology and network infrastructure that enables the transmission of the medical device data?

- Would Apple have to report to the FDA any changes that it makes to the iPhone's operating system?

Taking this example further, consider the accessory rule's potential elevation of an mHealth component to the device classification of the parent device.

- In the Apple example, is an iPhone that is part of an mHealth system with an implantable pacemaker or defibrillator regulated, under the accessory rule, as a Class III medical device?

- What happens if the same iPhone is used as part of an mHealth system with a glucometer that is a Class II medical device?

- Does a particular iPhone model have multiple classifications based on the highest classification of the device to which the smartphone is connected? Or, does the iPhone have one classification based on the highest classification of a device to which the smartphone *could* be connected?

- Does the functionality of the smartphone app that resides on the iPhone affect the application of the accessory rule?

Conclusion

The power of mHealth rests on its potential for widespread access and usability. To ensure this potential is harnessed, we must engage in a robust dialogue to determine how best to apply and interpret FDA regulations to the mHealth space. The lack of clarity surrounding the "accessory rule" poses a substantial obstacle to the growth of mHealth technology. The questions presented in this chapter are not all-encompassing, but are intended to demonstrate the complexity of the problem and the variety of the hardware components involved in any mHealth system.

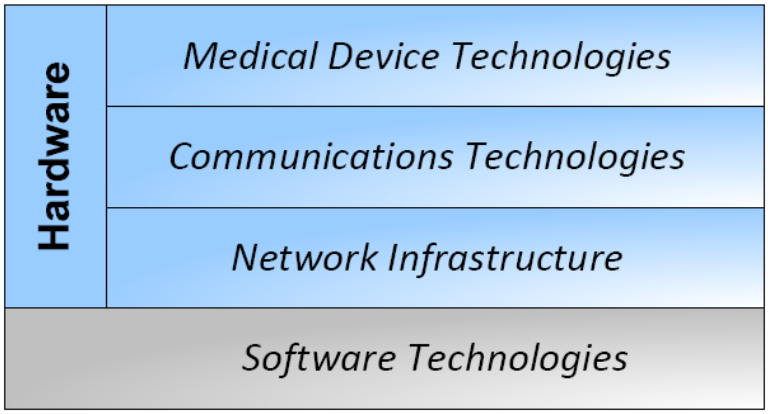
The next chapter draws our attention to the final of the four key elements of an mHealth system. Although touched on briefly in this chapter, we give software technologies particular focus because of the unique technological and regulatory features that distinguish software from hardware.

Chapter 4

FDA Regulation of Software Functionality in the mHealth World

In Chapter 2, we addressed various issues concerning intended uses and how a product's uses influence whether the product is a device. In Chapter 3, we discussed the issue of connections between hardware products in mHealth, considering whether something is an "accessory" to another medical device, a stand-alone device that simply happens to talk to other devices, or not a device at all. Throughout this whitepaper, we have referred to a conceptual framework built around the four key elements into which mHealth technologies can fall.

Figure 4.1: The Four Key Elements of an mHealth System



In this chapter, we again review that conceptual framework. Specifically, this chapter addresses the fourth category—Software Technology—explaining what software is for the purposes of mHealth, how the FDA historically has regulated software technology, and the implications that current regulation has for the future of mHealth.

Background: mHealth Software Applications

Definition of Software Technologies

We begin by providing a definition of software, focusing first on what software is *not*. Remember that Chapter 3 defined hardware to include only products that could be *physically* connected, such as a sensor to a device or a device to a mobile phone. Any functionality that happens without being attributable, traceable, or linkable directly to something physical was beyond the scope of the definition of hardware and thus our discussion of the "accessory rule".

This chapter discusses what remains. *For the purpose of this whitepaper, software functionality is defined as persistent information that includes both processing instructions and data, but that is not*

specifically traceable or directly involved in the operation of any particular physical product itself, and is itself non-physical in nature. In other words, if you tried to find out what "physical device" the software ran on, you would not necessarily be able to do it. Not surprisingly, software is of particular importance to mHealth because much of the storage and analysis of data being directly collected by sensors, wireless medical devices, and other physical products—most of which have their own internal software—very likely may be conducted remotely across interconnected networks through the Internet.

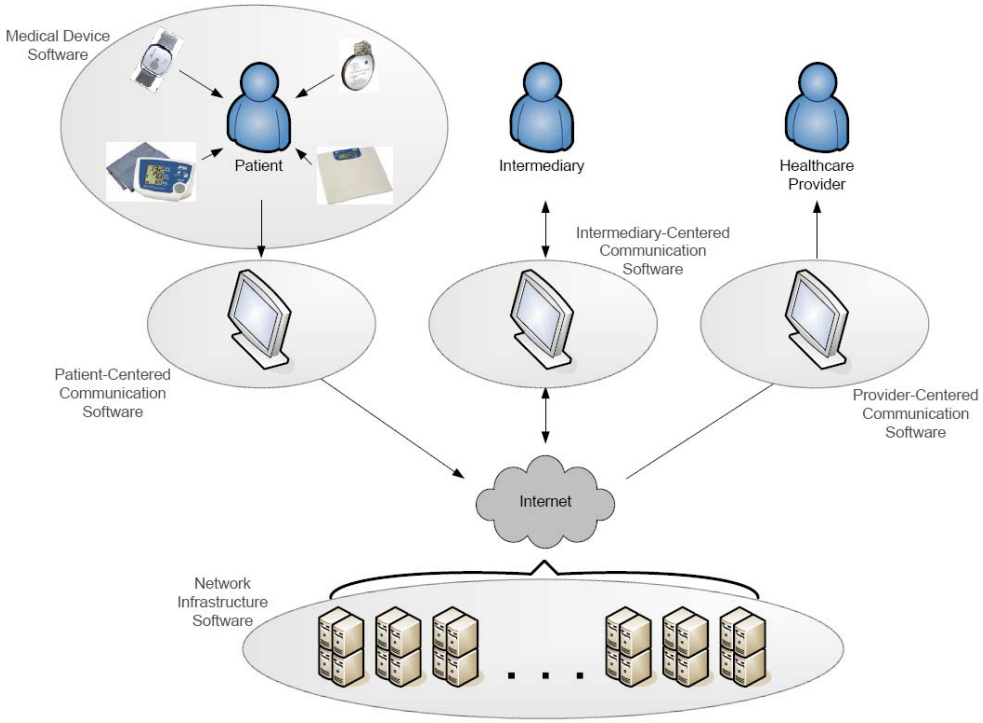
Hardware Components and Inherent Risk

For purposes of analyzing the appropriate level of FDA regulatory requirements, mHealth software must be understood from two different and distinct perspectives. The first is a basic understanding of the types of software involved in the components that comprise an mHealth system. The second is a more conceptual understanding of the continuum of risk associated with the use of software with mHealth technology.

The Component View

Software in the mHealth world can come in all shapes and sizes and can perform a variety of functions. Although software is purely non-physical, association with a tangible piece of hardware is required at some point throughout the web of interconnected hardware technology comprising the mHealth system. Figure 4.2 shows a simplified diagram of an mHealth system that illustrates the various elements that involve software applications, which can exist in whole or in part on any number of hardware components at any one time and can change locations at any moment.

Figure 4.2: Simplified Diagram of a Generic mHealth System



As Figure 4.2 illustrates, software can be found in any of the following mHealth components:

- Medical devices;
- Patient-centered communications technologies;
- Provider-centered communications technologies;
- Intermediary-centered communications technologies; and
- Network infrastructure technologies.

Because understanding the role of software in each of these mHealth components is helpful to understanding the FDA's regulatory requirements for software, we describe each of them in turn.

Medical Device Software

Software in a medical device can come in two forms: the first is called *firmware*, while the second uses the generic *software* term. Firmware is programming code that is embedded in a device and that allows the device to function properly.[46] An ICD, for example, contains thousands of lines of firmware code

[46] Firmware can be found in any electronic device that contains an embedded microprocessor, including a cellular phone, a wireless router, or implantable pacemaker. The firmware code is the fundamental information that allows the machine to function and is as elemental as a resistor, capacitor, or microchip. Firmware is not within the meaning of *software* as used in this whitepaper and will not be discussed.

that sets parameters and dictates how the medical device will respond to electrical activity within the heart. Software, on the other hand, is programming code that resides on a machine, using the device to perform certain analytical tasks. A trending feature on an electronic blood pressure cuff is an example of software that resides on a medical device, using the device as a host to perform a distinct task. The trending software does not control the basic functions of the blood pressure cuff, but merely performs a discrete analytical function as an "add-on" based on the data that the blood pressure cuff collects.

Patient-Centered Communication Technologies

Software also can be found outside of the medical device and at any point along the information pathway from the patient to the healthcare provider. Patient-centered communications technologies (e.g., a personal computer, smartphone, tablet, or proprietary communications device, etc.) can utilize software to perform analytical tasks or to control the transmission of patient data. Microsoft Outlook, for example, could be an integral software component of an mHealth system—its function being to email alerts to the healthcare provider regarding the patient's health status. A smartphone or tablet application is another example and may be used for displaying data trends, controlling the transmission of the information to the healthcare provider, or analyzing the data for specific disease conditions. Some mHealth systems may not use standard communications technologies but might design proprietary devices that use software in the same way.

Provider- and Intermediary-Centered Communications Technologies

Provider- and intermediary-centered communications technologies may be any of the same types of communications technologies used by the patient and can employ any of the types of software that are designed for patient use. The software also could be used for the same or different purposes as the patient-centered devices. An example of provider-centered software that is ***different*** from what a patient would use is an mHealth web application that allows the healthcare provider to access patient data for all of the provider's patients using the mHealth system. This web app would be accessed from the provider's personal computer and would display a variety of data collected by the mHealth system, including alert notifications, about all or a subset of the healthcare provider's patients (e.g., only those patients who have had a recent problem). An individual patient (or family member) may have access to the same web app but would only be able to view their own patient data.

A third-party intermediary might have access to the same web app or a separate software program that allows them to view the patient data and/or create trend reports or alert notifications to be sent to the healthcare provider. In some mHealth systems, these intermediary activities could be performed automatically by software that resides on network infrastructure components, such as a computer server in an internal, secure network system or an ISP server located outside of a proprietary network. Alternatively, some mHealth systems utilize an intermediary for aggregation purposes only, allowing limited access to the patient data. In these aggregation systems, the intermediary merely compiles the data into a usable form and transmits the compiled data to the healthcare provider for review. This aggregation function may be necessary for mHealth systems that incorporate multiple stand-alone medical devices that were not originally intended to function as part of an mHealth system.

Network Infrastructure Technologies

The network infrastructure of an mHealth system, as discussed in Chapter 3, can include any number of servers, mainframe computers, data storage devices, wireless routers, and telephone service switches, among other things. These are distinct from the patient-, provider-, and intermediary-centered communications technologies in that the network infrastructure technologies function independently of

the other technologies and require no involvement from the patient, clinician, or intermediary. Software that resides on these components may or may not be specific to the mHealth system. For example, an mHealth system that involves an intermediary for review of patient data may include a private network of servers that stores patient data in a database and that retrieves patient data for billing and customer service purposes. The database may be an integral part of the mHealth system, while the software that retrieves data for billing and customer service purposes is not.

The software, however, need not "reside" on a network infrastructure component in the way that software is traditionally downloaded onto a computer. Cloud computing, which is becoming more common in the consumer marketplace as well as the mHealth sphere, distributes software algorithms over a number of different networked hardware components. The fluidity of this type of software system is technically powerful, promoting advanced algorithmic capabilities, but makes identifying where the software "resides" increasingly difficult. Similarly, aspects of software that once were bundled in a specific software program are now being "outsourced" across the Internet to various developers who provide "software services". These software services perform standard functions, such as a search or payment function, across the network infrastructure and separate from any specific mHealth component.

Inherent Product Risk and Intended Use

In addition to a component-centric view, software in an mHealth system should be discussed as a function of its inherent risk and intended use because these two factors influence how the product will be regulated. Generally speaking, the intended uses of mHealth software can be broken into four categories:

1) Display and storage;

2) Transmission;

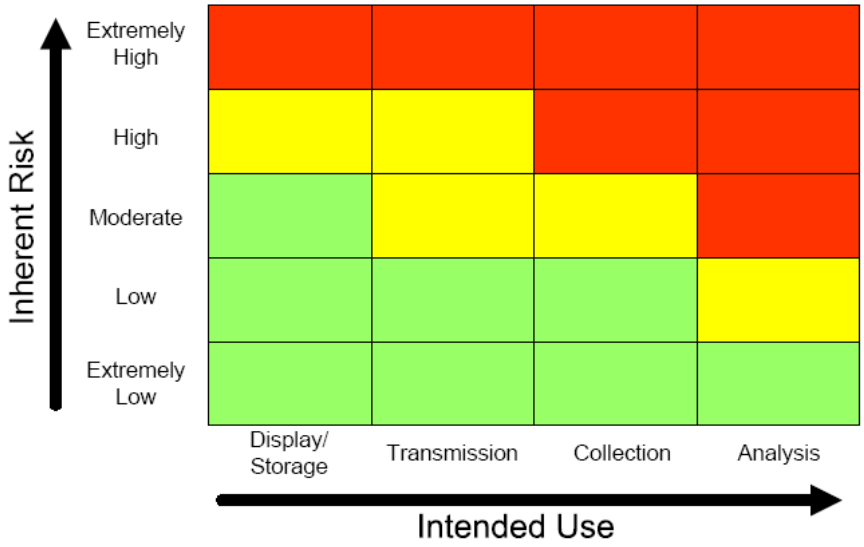
3) Collection; and

4) Analysis or conversion.

Inherent risk can be broken into five categories (ranging from extremely low to extremely high) based on the severity of an adverse event occurring as a result of the use of the software. Together, these two factors are indicative of the degree of regulatory oversight that may be applicable to a given software component in an mHealth system.

Figure 4.3 shows the relationship between the intended use of a particular software component in an mHealth system and its inherent risk and how those criteria determine the significance of controls that are needed to ensure the safety and effectiveness of the software component of the overall mHealth system (i.e., red being more significant and green being less).

Figure 4.3: Relationship of Intended Use, Inherent Risk, and Significance of Controls for a Software Component of an mHealth System



As explained in Chapter 2, the inherent risk of a given device or product—here a specific software application—varies based on the product's intended use. The threshold for characterizing software as a medical device and the level of controls required also depends on the intended use and inherent risk. For example, two software applications that are intended to display medical information collected in an mHealth system may be characterized differently depending on the data collected. A scale that displays an individual's weight has an extremely low inherent risk if the individual is merely using the data for personal wellness purposes, yet the same display of the same data may have a moderate or high inherent risk if the patient is required to notify a healthcare provider when their weight reaches a certain point.

The same can be said for software that is intended to transmit, collect, or analyze patient data. The inherent risk involved with software that transmits patient data, for instance, may be dependent on the data itself, the means of transmission, and the purpose of the transmission. Consider the following examples:

- **Data itself impacting inherent risk:** Transmission of an individual's weight may be low risk, while transmission of an alert that the patient's weight change indicates heart failure decompensation may have a high inherent risk.

- **Means of transmission impacting inherent risk:** Data transmission from an unsecured Internet gateway directly to a healthcare provider via email may involve more inherent risk than transmission of the same data from server-to-server within a secure, private network.

- **Purpose of data transmission impacting inherent risk:** Analysis (or collection) of a patient's weight for determining their body mass index may have a low inherent risk, while analyzing (or collecting) the same data for the purpose of predicting heart failure decompensation or the development of pulmonary edema may involve moderate or high inherent risks.

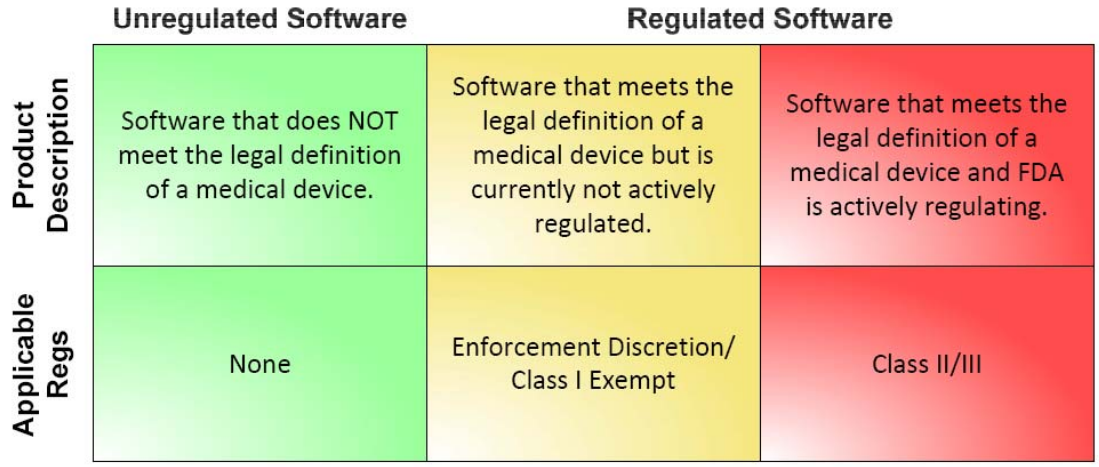
This discussion demonstrates the continuum of risk that exists for software components in an mHealth system and highlights the difficulty of regulating software in this new realm. The complexity of software architecture and functionality in an mHealth system may generate distinct risk levels for a given intended use. Furthermore, multiple software components in a given mHealth system may warrant different degrees of regulatory oversight.

Legal Framework: Regulation of Software as a Medical Device

Although the Food, Drug and Cosmetic Act does not specifically include the term *software* in the definition of a medical device, as with any other product, the FDA regulates software as a medical device if it meets the legal definition. As explained in Chapter 2, a product meets the statutory definition of a medical device, and thus becomes subject to FDA regulatory oversight, if it is "an instrument, apparatus, implement, . . . including any component, part, or accessory, which is . . . [either] *intended for use* in the diagnosis . . . or . . . cure of disease, . . . [or] *intended to affect* the structure or any function of the body of man . . . ."[47]

However, as discussed in more detail below, even software that meets that legal definition might not be actively regulated. Figure 4.4 summarizes the current regulatory framework for software as a medical device.

Figure 4.4: Overview of the Regulatory Structure for Software



Let's explore the current boundaries of FDA regulation within each of these categories.

Unregulated Software

Software that does not meet the legal definition of a medical device is not subject to FDA authority. Again, in order not to meet the legal definition, the software must not have as an intended use the diagnosis or treatment of disease.

[47] Food, Drug, and Cosmetic Act § 201(h) (emphasis added).

To date, the FDA has taken the position that unregulated software includes software that automates "manual office functions . . . for the ease of the user," such as "the report-writing functions of a computer system that allow for the manual (typewriter like) input of data by practitioners" and "software that merely performs library functions, such as storing, indexing, and retrieving information not specific to an individual patient . . . ."[48] The FDA has also indicated that "software that allows a doctor to enter or store a patient's health history in a computer file" is not regulated as a medical device.[49]

Regulated Software Not Subject to Premarket Clearance Requirements

The 1989 Draft Policy

Since the late 1980s, the FDA has publicly declared that there exists a category of software that technically qualifies as a medical device but for which the FDA has no intention of requiring the submission of a premarket notification or approval application.[50]

In 1989, the FDA established exemptions from regulatory oversight for two categories of software:

1) General purpose articles as defined in a regulation; and

2) Software that involves competent human intervention.[51]

The first category, *general purpose articles*, covers "laboratory equipment whose uses are generally known by persons trained in their use and which are not labeled or promoted for medical uses."[52] Additionally, via the classification process, the FDA has adopted specific general purpose or low risk exemptions that cover software. These exemptions include laboratory information management systems used as calculators or data processing modules for clinical use.[53] Although the second category of software involving *competent human intervention* is often cited, the FDA never actually codified the exemption.

About seven years after the FDA published the 1989 draft policy, it appeared the FDA was moving toward formalizing its computer product policy. In addition to publicly announcing that intention, the FDA hosted a large meeting in Washington and invited many stakeholders to discuss what the policy should be. In preparing for that meeting, the FDA drafted a summary of what it considered to be its then-existing policy on computer products. Those workshop materials explained that much of the software the Agency was seeing constituted accessories to medical devices, and the competent human intervention concept was only intended to apply to truly stand-alone software. The Agency also argued that the concept of what constitutes competent human intervention had become increasingly complex and difficult to administer. The FDA observed:

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[48] Devices: General Hospital and Personal Use Devices; Reclassification of Medical Device Data System, 73 Fed. Reg. 7498, 7500 (Feb. 8, 2008).

[49] *Id.*

[50] EHR systems, for example, have historically been considered medical devices but the FDA has used its enforcement discretion to refrain from active regulation.

[51] FDA Policy for the Regulation of Computer Products, 11/13/89 Draft.

[52] 21 C.F.R. § 862.2100.

[53] *Id.* § 807.65.

> In general, to permit competent human intervention, the software decision process must be completely clear to the user, with a reasonable opportunity for challenging the results. There must also be adequate time available for reflection on the results.

But again, the FDA never adopted a new regulation or policy.

Medical Device Data Systems

Most recently, in early 2008, "[the] FDA realized that the [1989] Draft Software Policy was not adequate to address all of the issues related to the regulation of computer based and software based medical devices."[54] The Agency proposed a new category of software—called *Medical Device Data Systems* (MDDS)—that would fit within this general category of regulated software exempt from premarket clearance as a Class I device. The FDA defined MDDS to include the following:

- The **electronic transfer or exchange of medical device data** from a medical device, without altering the function or parameters of any connected devices. For example, this would include software that interrogates a ventilator every fifteen minutes and transfers information about patient CO_2 levels to a central patient data repository.

- The **electronic storage and retrieval** of medical device data, without altering the function or parameters of connected devices. For example, this would include software that stores historical blood pressure information for later review by a healthcare provider.

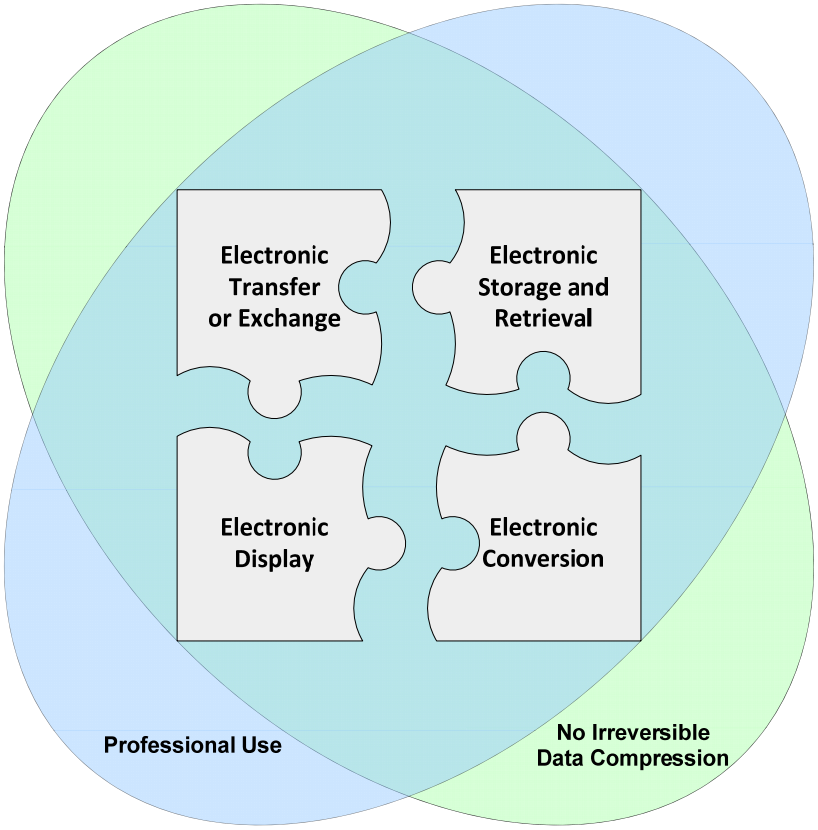
- The **electronic display** of medical device data, without altering the function or parameters of connected devices. For example, this would include software that displays the previously stored ECG for a particular patient.

- The **electronic conversion** of medical device data from one format to another format in accordance with a preset specification. For example, this would include software that converts digital data generated by a pulse oximeter into a digital format that can be printed.

MDDS is proposed only to be available as an exemption from premarket clearance so long as the data set is **intended for professional use and does not produce irreversible data compression**.

[54] Devices: General Hospital and Personal Use Devices; Reclassification of Medical Device Data System, 73 Fed. Reg. at 7499.

Figure 4.5: Proposed Medical Device Data Systems Regulation



To further understand how the proposed MDDS regulation applies to mHealth technologies, let's look at the details more closely. The proposed rule explains that "[e]xamples of [MDDS] that would be used in the home are systems that periodically collect data from glucose meters or blood pressure devices for later review by a healthcare provider."[55] The rule limits MDDS to software systems that "are not intended or designed to provide any real time, active, or online patient monitoring functions."[56] While MDDS can "deliver and store alarm data," such systems "do not have the capability to display, create, or detect alarm conditions, or to actually sound an alarm. In particular, a[n] MDDS can record the fact that an alarm sounded, but cannot by itself sound an alarm in response to patient information" or "create alarms that are not already present from the connected medical devices."[57] Finally, MDDS are not designed to "provide any diagnostic or clinical decision making functions" but "can transmit, exchange, store, or retrieve data in its original format" or can convert data "from one format to another," such as

[55] *Id.* at 7500. The rule defines *medical device data* as "numerical or other information available from a medical device in a form suitable for processing by computer" and explains that these data "can represent many types of information (e.g., clinical values, alarm conditions, error messages)." *Id.*

[56] *Id.*

[57] *Id.*

arranging or organizing data based on "preset specifications."[58] The proposed regulation does not define or clarify the preset specifications.

As of this writing, the Agency has not issued the MDDS proposed rule in final form. Recent pronouncements by the Director of the FDA's Center for Devices and Radiological Health suggest that a final rule may be published by the beginning of 2011. For the time being, however, it seems to be the best guidance available for deciding whether a premarket clearance is required for software in an mHealth system.

Software Requiring FDA Premarket Clearance or Approval

The third and final category—software that meets the definition of a medical device and that is actively regulated—requires premarket clearance or approval from the FDA. Although the classification of software in this category may seem to be the most obvious of the three general categories, the process of determining which regulation or policy applies is complicated by the fact that the word *software* is contained in 431 of the nearly 1700 classification regulations.

The FDA describes *software devices* that require premarket clearance or approval as products that contain one or more software components or are composed solely of software, including:

- Firmware and other means for software-based control of medical devices;
- Stand-alone software applications;
- Software intended for installation in general-purpose computers;
- Dedicated hardware/software medical devices; and
- Accessories to medical devices when those accessories contain or are composed of software.[59]

In addition, the proposed MDDS regulation indicates that "MDDS devices indicated for lay use or that perform irreversible data compression [should] not be exempt from premarket notification requirements."[60]

As with other devices requiring premarket clearance or approval, the software that falls into this category must comply with general controls, such as Good Manufacturing Practices, medical device reporting, and correction and removal requirements. The FDA also may apply special controls for devices, including software, that require premarket clearance. The special controls are typically stated in FDA guidance documents and include, for example:

- Guidance for Industry – Wireless Medical Telemetry Risks and Recommendations;
- Guidance for Industry, FDA Reviewers and Compliance on Off-The-Shelf Software Use in Medical Devices;

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[58] *Id.*

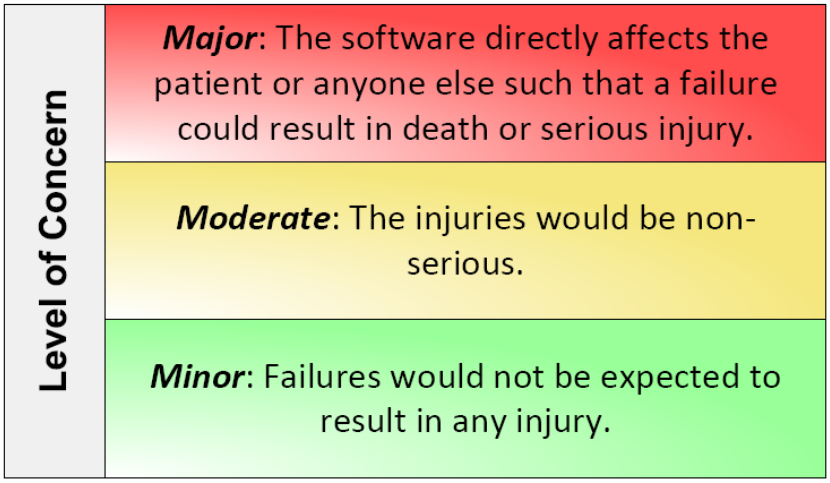
[59] Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices (May 2005).

[60] Devices: General Hospital and Personal Use Devices; Reclassification of Medical Device Data System, 73 Fed. Reg. at 7500.

- General Principles of Software Validation; Final Guidance for Industry and FDA Staff;
- Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices;
- Cybersecurity for Networked Medical Devices Containing Off-the-Shelf (OTS) Software; and
- Device-specific guidance (e.g. glucose monitors).

Within this category, the specific classification of the software also dictates the level of validation required. If the software is an accessory, the parent device determines the level of validation required. If not an accessory, the validation required depends on the "level of concern" that the FDA associates with the software, as described in Figure 4.6.[61]

Figure 4.6: Level of Concern Associated with Regulated Software that Is Not an Accessory to a Medical Device



The FDA evaluates the inherent risk and level of concern associated with the software to determine:

- The depth and degree of hazard analysis and mitigation that is expected;
- The depth and degree of documentation;
- What needs to be submitted as opposed to simply documented;
- The rigor applied to the verification and validation of the software; and
- The degree to which the device manufacturer's software development process is scrutinized.[62]

Further, the FDA has taken enforcement action against software developers who have failed to obtain premarket clearance or approval for their products. For instance, the Agency has issued a number of

[61] Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices (May 2005); Guidance for Industry, FDA Reviewers and Compliance on Off-The-Shelf Software Use in Medical Devices (Sept. 1999).

[62] Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices (May 2005).

Warning Letters relating to the unapproved marketing of software devices, representative examples of which include:

- *Digisonics, Inc. (1996):* The FDA cited the unauthorized manufacture and distribution of software used in conjunction with cardiac diagnostic and fetal growth development systems, specifically noting a failure to establish and implement adequate quality assurance procedures to address changes to the software.[63]

- *Individual Monitoring Systems, Inc. (1999):* The FDA cited the ActiTrac Activity Monitor, Display and Analysis Software and its Sleep Scoring Program because the "claims represent[ed] or suggest[ed] that the [software] devices are used to monitor or provide physiological data to evaluate a patient's medical condition (i.e., insomnia) for diagnosis and treatment of a sleep disorder."[64]

- *AvidCare Corp. (2001):* The FDA cited a failure to obtain premarket clearance or approval for the company's Home Health Monitoring Systems and associated software, which were deemed to be medical devices because they "use[d] spirometry for in-home monitoring of asthma."[65]

- *Lexicor Medical Technology Inc. (2003):* The FDA cited the company's "'DataLex' web portal", which had been promoted as being able to diagnose Attention Deficit Hyperactive Disorder in humans.[66]

- *BioImagene, Inc. (2005):* The FDA cited the company's "hardware-independent, Web-enabled software [that] allow[ed] pathologists to view and analyze immunohistochemically-stained . . . slides from any computer via the Internet."[67] The Agency found the unapproved marketing of the software as "an intelligent image analysis software system designed to fulfill the needs of objective analysis of oncopathology images" and "caters to the smarter diagnostic practices needed by researches, oncopathologists, and physicians . . . ."[68]

- *Seryx, Inc. (2007):* The FDA determined the company's Signature Genetics software to be a device because the software was "used to analyze data and generate a patient-specific report via . . . interpretation of a patient's genotype for several drug metabolizing enzymes."[69]

These enforcement actions are examples of the broad approach the FDA takes to the regulation of software as a medical device. The Agency has regulated Internet sites, in-home monitoring systems, and imaging software as medical devices, while at the same time exempting certain categories of systems

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[63] FDA Warning Letter to Diana McSherry, Chairman and CEO, Digisonics, Inc., Nov. 14, 1996, *available at* http://www.fda.gov/downloads/ICECI/EnforcementActions/WarningLetters/1996/UCM065074.pdf.

[64] FDA Warning Letter to David T. Krausman, Vice President and CEO, Individual Monitoring Systems, Inc., July 28, 1999, *available at* http://www.fda.gov/downloads/ICECI/EnforcementActions/WarningLetters/1999/UCM067527.pdf.

[65] FDA Warning Letter to Boaz Avitall, Chairman and CTO, AvidCare Corporation, Apr. 17, 2001, *available at* http://www.fda.gov/downloads/ICECI/EnforcementActions/WarningLetters/2001/UCM069569.pdf.

[66] FDA Warning Letter to Stephen N. Xenakis, President and CEO, Lexicor Medical Technology Inc., Jan. 16, 2003, *available at* http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2003/ucm147274.htm.

[67] FDA Warning Letter to Mohan Uttarwar, President, BioImagene, Inc., *supra* note 22.

[68] *Id.*

[69] FDA Warning Letter to Patrick Rambaud, President and CEO, Seryx, Inc., *supra* note 21.

such as an MDDS or general purpose article. The difficulty that mHealth technology companies face is determining when premarket clearance or approval is required. Below we discuss some of the challenges that these companies face in making this determination due to the complexities of the software technologies that form the basis of mHealth systems.

Challenges: Applying the Appropriate Regulatory Requirements

The distinctions just discussed represent the current state of a regulatory environment that has already struggled to keep pace with the rapid evolution of how software is used as, and in connection with, medical devices. As mHealth technologies continue to develop, we expect the gap between the current regulatory framework and the state of the art to expand even more. Some of the questions that must be addressed to bridge this gap are presented below.

What Software Is Regulated as a Medical Device?

Software that Automates a Function for Ease-of-Use

As noted above, the FDA has said that software that merely automates a function for ease-of-use is not regulated as a medical device. Consider the following:

- How would the FDA classify software that sends notifications to a patient to take a pill or to remind them to visit their healthcare provider?
    - Is such software not regulated as a medical device because it is simply automating the function of a healthcare provider (e.g., a physician, nurse, or pharmacist) who would normally contact the patient to remind them?
    - If it is regulated as a medical device, would the software be classified under the MDDS proposed rule as a Class I device exempt from premarket notification requirements?
- Does the physical location of the software dictate whether and to what extent the product is regulated as a medical device?
    - If the software system is intended to function in the patient's home rather than the healthcare provider's office, is the software subject to regulation as a medical device even if it merely automates a function for ease-of-use? What if the software system is located on an intermediary computer or server?

Software that Performs Library Functions

Software that merely performs library functions, such as storing, indexing, and retrieving information not specific to an individual patient, also historically has not been regulated as a medical device. Consider the following:

- Is a web app that retrieves data from a manufacturer's database/server in order to display alerts and patient information for all of a healthcare provider's ICD patients regulated as a medical device if the storing, indexing, and retrieving process is not specific to an individual patient?

  - If the web app is regulated as a medical device, would the device classification depend on whether the web app used standard protocols and standardized web services as opposed to proprietary ones?

- Is a software app stored on a proprietary communication device located in the patient's home regulated as a medical device if it asks the patient questions and transmits the patient's answers to a healthcare provider?

  - If such software is a medical device, does the device classification depend on the types of questions being asked and the purpose of those questions, even though the processes for posing the questions and transmitting the answers are identical?

Provider-Derived Software

An area of increasing uncertainty is the regulation of provider-derived software that performs mHealth functions. The FDA has historically exercised its enforcement discretion to refrain from regulating EHR and EMR systems. Many mHealth systems, however, connect to EMR and EHR systems established in a given healthcare facility, generating the following questions:

- Would the connection to an mHealth system subject a provider-derived software system to regulation as a medical device if the systems are intended to connect? If so, what classification would apply?

  - What if the systems use standard protocols to connect to each other?

- If the entire mHealth system, including the software components, is developed within a healthcare facility, is the system subject to regulation as a medical device? If so, is the classification the same as a system that is derived outside of the healthcare facility?

What Software Is a Device, But Is Exempt from General Controls and Premarket Notification?

Software as a General Purpose Article

Software that qualifies as a general purpose article that is not labeled or promoted for a medical use and has a use generally known by persons trained in its use is exempt under 21 C.F.R. § 807.65 from device registration requirements.

- How far does the general purpose article exemption extend?

  - For example, if an mHealth system incorporates a computer or smartphone to allow a healthcare provider access to patient data via a web app server, is the computer a general purpose article?

  - If so, is the Internet server that allows the computer to access the web application server exempt from device registration requirements as a general purpose article?

  - If so, is the web app exempt?

- If the web app is executed in a cloud computing network, does the general purpose article exemption apply to the software and all components that might execute a piece of that software?

Software Involving Competent Human Intervention

Software that involves competent human intervention also has been considered exempt from premarket notification requirements under the 1989 draft policy.

- Does this exemption still exist? If so, what constitutes "competent human intervention"?
- Would a third-party intermediary who is a trained clinician (e.g., physician, nurse, or other healthcare provider) qualify under this exemption?
- Does software that allows that intermediary to view patient data and make decisions whether to send alert notifications to the healthcare provider qualify under this exemption?
- Does the competent human have to be a trained clinician (e.g., physician, nurse, or other healthcare provider)? If the software simply requires that the patient click a button to send data to their healthcare provider, will the software qualify for this exemption?

Software Involving MDDS

MDDS software that is intended for professional use and that does not produce irreversible data compression has been proposed to be Class I exempt from premarket clearance requirements. Consider the following:

- What classification applies to software that is intended for use by a lay person?
  - Does the "professional use" requirement mean that *any* licensed professional (e.g., nurse, physician assistant, or other healthcare provider) can access the data or is the scope limited to that of a physician? For example, if an mHealth system uses software that is stored on an intermediary's server system for review by trained clinical staff prior to transmission to the patient's healthcare provider, is the software regulated as a medical device under the MDDS proposed rule?
- What classification applies to software that performs some irreversible data compression?
  - Does the "no irreversible data compression" requirement apply if software in an mHealth system displays data as a trend or analyzes data in some other fashion that does not change the original data?
- If an mHealth system incorporates software that periodically collects and aggregates data from multiple devices and transmits that data for review by the patient's healthcare provider, does that software fall within the MDDS Class I exemption?
  - Does the aggregation function constitute an electronic conversion within the meaning of MDDS?
  - If the data from the multiple devices are displayed together in one screen or report, does this constitute an electronic display within the meaning of MDDS?

- How is a software device classified if it is designed or intended to provide real-time or active remote patient monitoring and, therefore, does not fall within the proposed Class I category for MDDS?
    - What is considered "real-time" or "active monitoring" in this context? How frequently can an mHealth system transmit data and still be within the MDDS proposed rule?
- What classification would software receive if the mHealth system notifies a healthcare provider of an alert condition?
    - What if the software simply transmits the existence of an alert on the medical device?
    - What if a third-party intermediary reviews medical device data and uses software to notify a healthcare provider of an alert condition?
- What classification would software receive if the mHealth system notifies the patient of an alert condition? What if the software notifies a family member of the patient?
    - Does the answer depend on the content or the purpose of the alert? For instance, is the classification different if the alert notifies the patient of the need to take a pill or that the patient has a scheduled physician appointment as compared to notifying the patient that they have *missed* a required pill or appointment?
    - Does the classification change if the software notifies a third-party intermediary who subsequently contacts (via phone or other means of communication) the patient or physician of the alert condition?
- What classification would apply to software in an mHealth system that transmits the diagnostic or clinical decisions made by a trained intermediary?

What Software Is Regulated as a Device by Virtue of the Accessory Rule?

The ambiguity of the accessory rule has significant implications on the regulation of software. The questions addressed previously in Chapter 3 apply here and will, therefore, not be repeated. Suffice it to say that questions remain regarding smartphone manufacturers and Internet Service Providers, among others, because it is unclear how the accessory rule applies to software applications. Specifically, regulation of software that resides on a smartphone or that uses a "cloud" of networked computers and servers may implicate the manufacturers of the hardware components. If and when the accessory rule breaks down in the mHealth context, the current rules for regulating software also fail because they cannot cover the complexity of the software architectures and the variety of mHealth systems that are under development and that continue to evolve. Where software once was considered a medical device under the accessory rule, the challenges presented draw into question the appropriateness of such a classification.

Consider the following questions regarding the application of the current accessory to software:

- For what purposes can a software application access medical device data without being considered an accessory?

  - Is a software app that enables a device manufacturer to review patient data for billing or customer service purposes an accessory by virtue of the connection to the manufacturer's device?

- Is software that forms the basic operating systems of the various hardware components (e.g., computers, smartphones, and servers) regulated as an accessory if the hardware component is regulated as an accessory?

- Is software that is otherwise unregulated as a medical device subject to the accessory rule?

- Is software that falls within the MDDS proposed classification subject to the accessory rule?

What Software Is Regulated as a Device that Requires Premarket Clearance?

Software that is considered a medical device but is not an accessory is regulated under the inherent risk and level of concern analysis. The following questions demonstrate the uncertainty that surrounds this analysis:

- Does the analysis change based on the intended location of the software within the mHealth system?

  - For instance, is a software app that runs on a smartphone and provides emergency notifications directly to the healthcare provider of a greater or lesser risk/concern than the same software app that resides on the healthcare provider's office computer, where notification might not be as immediate?

  - Does the answer change if the software does not "reside" anywhere?

- Similarly, does the software communication functionality affect the regulatory oversight?

  - For instance, is software that uses an email notification service regulated differently than software that sends text messages?

  - Is the content of the email or text message relevant given length limitations?

  - If the notification simply informs the healthcare provider to contact the patient or informs the patient to contact the healthcare provider, does the software involve more or less risk and concern than if the notification provided specific patient data?

- Does the software classification depend on the classification of the hardware component on which the software executes?

  - For instance, if a computer is considered an accessory to a Class II medical device, does downloading software to that computer subject the software to Class II regulation? Does the answer depend on the intended use of the software?

  - What classification would apply if the software does not "reside" on any specific device?

Conclusion

As demonstrated in the discussion in the chapter, the changing landscape of software development and the intangibility of software itself makes regulation in the mHealth sphere more and more difficult as the technologies advance. Software is an integral component of any mHealth system and obtaining clarity and predictability around how the FDA will regulate in this space is essential to continued growth and innovation. The public health advances that come with the growth of mHealth technologies justify the discussion and effort necessary to establish clear and predictable regulatory guidelines for associated software technologies.

Chapter 5

Conclusion: Innovation and the Impact of Regulation

The advancement of public health is a mission shared by the FDA and developers of mHealth technologies. Innovation within the mHealth industry has grown rapidly in recent years primarily due to the development of the Internet as well as the availability of high-speed mobile and wireless communication technologies and the hardware and software equipment that enable individual consumers to "stay connected" from virtually anywhere and everywhere.[70] In the same way that social media tools (e.g., Facebook and Twitter) have broken the traditional barriers of communication in our society, mHealth technologies (through mobile and wireless communications systems) have empowered physicians and their patients with the freedom of delivering and receiving healthcare outside of the confines of a traditional healthcare facility. With the growing cost pressures in healthcare, the increasing familiarity with mobile devices, and the ever-expanding population of patients with chronic disease conditions, mHealth technologies have become, and will continue to be, a vital component of the healthcare system in the United States.

The FDA plays an essential part in the growth of the mHealth industry and the delivery of mHealth technologies. The Agency acts as a check on industry to ensure that technological development does not come at the expense of the safety and effectiveness of products that reach the market. To date, the FDA has relied primarily on the existing framework for medical devices to regulate mHealth technologies. Unfortunately, the established framework fails to address adequately many of the aspects of mHealth systems that make the technology powerful.

In this whitepaper, we have attempted to identify the areas where improved clarity and guidance from the FDA is necessary to ensure the continued growth of the mHealth industry and the delivery of mHealth technologies to patients and healthcare providers. First, we established a definition of *mHealth* and provided descriptions of the four key elements that form the fundamental architecture of an mHealth system. Next, we discussed in detail the three areas of primary concern: 1) intended use; 2) connected hardware; and 3) software functionality.

To briefly review, the question of intended use in mHealth poses a significant concern for the future of the industry because a product's intended use forms the basis upon which the FDA has authority to regulate. The Agency's authority is limited, in relevant part, to products intended for use to diagnose or treat a medical condition. Many mHealth products currently are designed to address general health and wellness problems, and the dividing line between wellness and medical diagnosis or treatment is unclear. This whitepaper presented a number of questions that highlight the need for clarity.

Next, regulation of hardware components within an mHealth system is the second key area in which the current regulatory framework fails to provide clear guidance. An mHealth system is composed of a myriad of hardware components that work in concert to perform various data collection, storage,

[70] The summit of Mt. Everest—the highest point on Earth—recently became one of the most wirelessly accessible locations on the planet.

display, analysis, and transmission functions. These components interact through wired and wireless connections that rely on both standard and proprietary communications protocols. Many of these components are designed and developed beyond the reach of the mHealth system manufacturer and may be controlled by national standardization bodies or large corporations. As such, regulation of these components of an mHealth system—and how practically to comply with any FDA requirements—poses significant challenges.

Third and finally, the regulatory framework that applies to software within an mHealth system is uncertain. Historically, software with specifically defined features has been regulated as a medical device; at the same time, the FDA has not finalized several rules that would establish basic guidelines for the regulation of software as a medical device and has not published an mHealth-specific app guidance document. As with the other areas discussed in this whitepaper, the mHealth industry thirsts for guidance from the FDA on how the Agency intends to regulate the software component of mHealth technology. The lack of clear guidelines creates significant uncertainty that will hinder the innovative spirit of the mHealth industry if the regulatory ambiguity persists.

For these reasons, the mHealth Regulatory Coalition has developed this whitepaper and hopes to begin a discussion between mHealth stakeholders and the FDA regarding the regulation of mHealth technologies. Ultimately, we hope that this discussion will result in the development of a guidance document that provides a clear and predictable regulatory pathway that fosters innovation and ensures the safety and effectiveness of mHealth technologies.

The task of developing such a guidance document parallels the Agency's recent efforts to establish guidelines for dietary supplements. Prior to the growth of the dietary supplement industry, medical science did not truly understand the relationship between diet and health. As development of new dietary supplements illuminated the relationship with improved overall health, a dialogue began on the impact on specific diseases or conditions. The discussion of specific diseases or conditions required the FDA to address the potential for a dietary supplement to become a drug under the Food, Drug and Cosmetic Act. Congress finally entered the discussion and amended the Agency's statutory authority to allow consumers to make informed decisions about the use of dietary supplements to improve their health.

Although the regulation of mHealth technology follows a similar path as dietary supplements, a statutory amendment is not required because the FDA currently has the authority to establish a clear regulatory framework upon which the mHealth industry can rely. Where these two examples are similar, however, is in the need for freedom to discuss the health benefits of wellness products, specifically where clear medical consensus exists around a particular health condition. The ability to make marketing statements based on clear medical consensus will enable the widespread use of mHealth technologies, thereby improving public health through education and use of these technologies. The FDA and the guidance documents that the Agency establishes play a vital role in this endeavor.

Appendix

List of Abbreviations

Act	Food, Drug and Cosmetic Act
App	Software or Web Application
BAN	Body Area Network
CCR	Continuity of Care Record
DAS	Distributed Antenna System
DSL	Digital Subscriber Line
ECG	Electrocardiogram
EHR	Electronic Health Record
EMR	Electronic Medical Record
FDA	Food and Drug Administration
ICD	Implantable Cardioverter Defibrillator
ISP	Internet Service Provider
LAN	Local Area Network
LTE	Long-term Evolution
M2M	Machine to machine
MCOT	Mobile Cardiac Outpatient Telemetry
PAN	Personal Area Network
PDA	Personal Digital Assistant
PHR	Personal Health Record
PSTN or POTS	Public Switched Telephone Network or Plain Old Telephone Service
RFID	Radiofrequency Identification
RTLS	Real-time Locating System
SMS	Short Message Service

Attachment D:
MRC’s Proposed Guidance

Foreword to the Proposed Guidance Document

The mHealth Regulatory Coalition ("MRC" or "Coalition") is a diverse group of mobile health ("mHealth")[1] non-governmental representatives, non-profit associations, patient advocacy organizations, health care payors, and individual as well as integrated health care professionals. Industry members include traditional medical device manufacturers, mobile app developers, online marketplaces for mobile apps, mobile platform manufacturers, telecommunications service providers, and information and communications technology companies.

The MRC formed in July 2010 with the goal of answering ***two fundamental questions***: 1) ***what mHealth products should the U.S. Food & Drug Administration*** ("FDA" or "Agency") ***regulate*** and 2) if such products are regulated, ***in what device classification*** should the FDA place them? The Coalition chose to address these questions because its members believe that the interests of the public health and patient safety demand appropriately tailored FDA oversight. With those goals in mind, the Coalition concluded that only those mHealth technologies that reach a moderate or high level of risk warrant scrutiny. Moreover, the development of ***a clear, predictable, and targeted regulatory framework will promote innovation and discovery*** of new ways to improve the delivery of care, ***reduce the cost of health care***, ***facilitate private investment*** in large and small businesses in the mHealth industry, and ***stimulate job creation*** in the United States.

As the Coalition set its course for answering these fundamental questions, we established two major work products: a whitepaper that identifies the open regulatory issues that exist in the mHealth space; and a proposed guidance document that describes the regulatory framework that we believe properly balances the interest of the public, the FDA, and the industry. In December 2010, we published the whitepaper[2] after having spent nearly five months meeting internally along with external stakeholders (e.g., entrepreneurs and the medical device industry) to learn about their mHealth regulatory positions and business plans.

We are now publishing our second work product—this proposed guidance—after ten months of internal deliberation and public comment.[3] The outcome is a document that specifically addresses the two fundamental questions we identified at the outset. More specifically, this proposed guidance addresses: 1) the types of intended uses that a product may have and associated claims that a manufacturer can make about a product without it being regulated as a medical device; 2) the framework for addressing products that have traditionally been regulated as accessories to other medical devices; and 3) a framework for software in an mHealth system. As each of these involves evaluation of risk, the proposed guidance describes a risk model that the Coalition believes can be used as a means of assessing risk associated with specific products in an mHealth system.

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[1] We use the term *mHealth* as a short form of *mobile health*, which encompasses the use of mobile technology in a wide array of health care settings, including in-hospital, in-home, and on-the-go.

[2] BRADLEY MERRILL THOMPSON ET AL., A CALL FOR CLARITY: OPEN QUESTIONS ON THE SCOPE OF FDA REGULATION OF MHEALTH (2010), *available at* http://mhealthregulatorycoalition.org/wp-content/uploads/2010/12/mrcwhitefinal122210.pdf.

[3] Working drafts of this proposed guidance were made available via the MRC's website, links to which were published in social media forums (e.g., LinkedIn and MobiHealthNews.org) as well as in traditional news outlets. In addition, the Coalition held an open meeting at the Continua/ATA Policy Summit in July 2011 to discuss a draft of this proposed guidance.

Ultimately, the Coalition's purpose is to propose a means by which FDA can tailor its existing regulatory framework to mHealth technologies at a level of specificity that would be meaningful. Therefore, in drafting this proposed guidance we have tried to step into the shoes of the Agency and written this in a way that the Coalition believes the FDA could reasonably implement the proposed principles through their good guidance practices. In certain instances, however, we have made recommendations to FDA that would need to be accomplished through a means outside this guidance. In particular, we believe that FDA needs to engage in rulemaking to develop new classifications for accessories and mHealth software, which we describe in Appendix B. To be clear, the Coalition is not proposing to establish a new classification scheme for mHealth products; instead, our proposal tailors the existing regulatory framework to mHealth products, including identifying a number of product types that might fall within an mHealth system for which there does not currently exist a classification regulation.

MRC's Proposed Guidance on Regulation of mHealth Technologies

Submitted by the mHealth Regulatory Coalition
to the Food and Drug Administration

October 19, 2011

Table of Contents

I. Introduction

With the rapid growth and diversification of mobile health ("mHealth") technologies, there is a need for guidance from FDA on what types of intended use claims subject mHealth products to the Agency's regulatory authority. Certain mHealth products technically fall within FDA's jurisdiction but are intended for uses that present very low risk to patient safety. FDA is choosing to exercise its enforcement discretion with respect to these types of claims. For other mHealth products, FDA jurisdiction is unclear due to ambiguity in the language of the statute and associated claim terminology. This guidance is intended to clarify FDA's current thinking on what types of "ambiguous" mHealth products fall outside of the agency's jurisdiction. More specifically, this guidance describes what types of mHealth products are regulated and how a classification determination should be made.

II. Scope

This guidance document describes the types of mHealth products that are excluded from FDA regulation as well as the process that FDA recommends to determine an mHealth product's regulatory status. The scope is limited to intended use claims relating to mHealth products and does not address questions regarding evidence of intended uses for a given product. This guidance document is further limited in scope to the process by which FDA recommends to determine whether a particular mHealth product, based on its intended use claims, would be regulated. This document does not, however, describe to what extent a *particular product* will be regulated (if regulated).

This guidance document also describes the accessory rule and its application to mHealth products, as well as the regulation of software products used in mHealth systems. The software regulatory framework is not intended to apply to all software used as part of a medical device. Instead, this document focuses on the types of software that an mHealth system might incorporate. Unless otherwise specified, the principles developed in this guidance document apply equally to hardware and software within an mHealth system.

III. Definitions

The following terms are used throughout the guidance document.

Accessory: A finished medical device that is distributed separately but intended to be attached to or used in conjunction with another finished medical device.[4]

Caregiver: An individual who is not a health care professional but who provides personal care for another individual. An example of a caregiver is a family member or professional health educator (e.g., lifestyle/health coach or educator). An individual who would otherwise be considered a health care professional may also be a caregiver if the individual is acting in a caregiver-capacity.

[4] CTR. FOR DEVICES & RADIOLOGICAL HEALTH, FOOD & DRUG ADMIN., PUB. NO. FDA 97-4179, MEDICAL DEVICE QUALITY SYSTEMS MANUAL: A SMALL ENTITY COMPLIANCE GUIDE (1996), *available at* http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/QualitySystemsRegulations/MedicalDeviceQualitySystemsManual/default.htm.

Cloud Computing: Cloud computing is the use of distributed and/or virtual computing platforms to perform specific analytical or administrative functions. The term "software as a service" is often used to describe software programs that are hosted and/or performed in the "cloud" (i.e., the network of distributed computing platforms).

Component: A component is a product (finished or unfinished) that is intended to be purchased by the manufacturer of the finished device in which the product will be incorporated.[5] A component is distinguished from an accessory based on the purchaser of the product—an end-user buys an accessory, while a manufacturer buys a component.[6]

Consumer: A consumer is an individual who is not diagnosed or being treated for an illness by a health care professional through the mHealth product. Examples of a consumer include an individual who utilizes a medical device for personal use or who obtains specific wellness advice from a caregiver.

Disease: For purposes of this guidance, a disease is damage to an organ, part, structure, or system of the body such that it does not function properly (e.g., cardiovascular disease), or a state of health leading to such dysfunction (e.g., hypertension). Behavioral activities (e.g., general lack of exercise or poor nutritional habits) are not included in this definition.

Disease Claim: A disease claim is any claim, not including a health claim, made on the label or in labeling of a product that demonstrates, expressly or impliedly, that the intended use of the product is to diagnose, treat, or prevent a disease.

Electronic Health Record (EHR): An EHR is an electronic record of health-related information for a patient that contains information captured from a variety of sources (e.g., during clinical visits from various health care professionals), including vital statistics, lab and imaging studies, and other information important to the patient's medical history.

Electronic Medical Record (EMR): An EMR is an electronic record of health-related information used exclusively by one or more health care providers (e.g., hospital or ambulatory care facility) as the legal record of a patient's health information.

Firmware: Firmware is fixed, embedded programs and/or data structures that internally control the proper functioning of a hardware device.

General Purpose Article: A general purpose article is a product that is not labeled or promoted for medical uses but which, by virtue of its application in health care, meets the definition of a medical device. These products either pose little or no risk, or are appropriately the sole responsibility of the health care professionals who have used them in medical applications. Examples of a general purpose article include a personal computer that has been programmed by a clinical chemist to display values from tests on human specimens; and a database management system, with no medical claims, that is used by a health care

[5] 21 C.F.R. § 820.3(c).

[6] In some cases, a component that is sold directly to an end user as a replacement part is regulated as a finished medical device. *See, e.g.*, 21 C.F.R. § 890.3920 (designating wheelchair components sold as replacement parts as Class I devices).

professional to identify patients at risk for a given medical procedure.[7] A general purpose article may also include a software application design for home-use by a caregiver to record medical information.

Generally Recognized Health Claim: A generally recognized health claim is a health claim for which there is general recognition, among qualified experts, that the product has been adequately shown to be safe under the conditions of its intended use. The source of evidence to support a claim of general recognition may include current, published, authoritative support from certain federal scientific bodies (e.g., NIH, CDC, the Surgeon General), the National Academy of Sciences, the American Medical Association, or other similar professional organization.

Health Care Professional: A health care professional is a physician or other medical professional 1) who is licensed under State law to prescribe drugs or devices,[8] or 2) whose primary purpose is to examine, evaluate, and treat or refer patients for examination, evaluation, or treatment by another physician or medical professional. Examples of a health care professional include medical doctors, dentists, chiropractors, optometrists, nurse practitioners, case managers, school nurses, and veterinarians.[9] A health care professional acts in his or her professional capacity when the individual examines, evaluates, or treats (or refers for examination, evaluation, or treatment of) an individual for a specific disease or medical condition.

Health Claim: A health claim is any claim made on the label or in labeling of a product that expressly or impliedly characterizes the relationship of the product to a disease or health-related condition. Implied health claims include third-party references, written statements (e.g., a brand name including a term such as "heart"), symbols (e.g., a heart symbol or •), or other forms of communication that suggest, within the context in which they are presented, that a relationship exists between the mHealth product and a disease or health-related condition.

Level of Concern: Level of concern refers to an estimate of the severity of injury that a device could permit or inflict, either directly or indirectly, on a patient or operator as a result of device failures, design flaws, or simply by virtue of employing the device for its intended use. Level of Concern is not related to device classification (Class I, II or III) or to hazard or risk analysis per se.[10]

Medical Advice: Medical advice is a health-related recommendation that is provided to a patient

[7] CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., DRAFT POLICY FOR THE REGULATION OF COMPUTER PRODUCTS 2 (1989); *see also* 21 C.F.R. § 807.65(c).

[8] *See* 21 C.F.R. § 99.3 (defining *health care practitioner* for purposes of dissemination of information on unapproved uses for marketed drugs, biologics, and devices).

[9] *See* 21 C.F.R. § 803.3 (defining *physician's office* in the medical device reporting context).

[10] CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., GUIDANCE FOR THE CONTENT OF PREMARKET SUBMISSIONS FOR SOFTWARE CONTAINED IN MEDICAL DEVICES 4–8 (2005), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm089593.pdf; *see also* CTR. FOR DEVICES & RADIOLOGICAL HEALTH, U.S. FOOD & DRUG ADMIN., GUIDANCE FOR INDUSTRY, FDA REVIEWERS AND COMPLIANCE ON OFF-THE-SHELF SOFTWARE USE IN MEDICAL DEVICES (1999), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073779.pdf.

by a health care professional in furtherance of an examination, evaluation, or treatment of the patient.

Medical Device: A medical device (or device) is "an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including any component, part, or accessory, which is . . . intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or . . . intended to affect the structure or any function of the body of man or other animals, and which does not achieve its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of its primary intended purposes."[11]

Medical Device Data: Medical device data are any information generated from a medical device or manually entered into a medical device for use or analysis by the medical device.

Medical Data: Medical data are any patient-specific information generated as a result of a medical examination, evaluation, or treatment ordered or conducted by a health care professional.

Mobile Application: A mobile application (or mobile app) is software that is designed for use on in a mobile setting (e.g., hardware or software-based virtual machine on a smartphone, tablet computer, laptop computer, or other similar mobile product).

Parent device: A parent device is a finished device to which an accessory is attached or with which an accessory is used (e.g., via wireless communication).

Patient: A patient is an individual who seeks the assistance of a health care professional for the examination, evaluation, or treatment of a disease or health-related condition.

Personal Health Record (PHR): A PHR is an electronic record of health information that is maintained, controlled, and shared by a consumer. A PHR consists of health-related data that are generated and entered by the consumer and can incorporate data from both EMRs and EHRs.

Software: Software is programming code (e.g., instructions or machine commands) that employs a machine or multiple machines, any of which can be real or virtual, to perform certain analytical tasks not specifically traceable to the operation of any particular physical product. Software is inherently non-physical in nature. Common terms include "software", "software application", "software app", "software program", "app", or "program". Examples include stand-alone programs for use on a computer or mobile phone, including mobile apps; web-based applications; programs that perform functions on multiple machines (e.g., "cloud computing"); and modularized, third-party software that performs discrete functions (e.g., "software-as-a-service").

[11] Food, Drug, and Cosmetic Act, § 201(h), 21 U.S.C. § 321(h).

Software device: A software device is software that meets the definition of a medical device. Software that would otherwise be a general purpose article, but which is modified by the user outside of the original manufacturer's specifications, would constitute a software device.

Software manufacturer: A software manufacturer is any person or entity who creates, designs, develops, labels, re-labels, remanufactures, or modifies software or who creates a software system from multiple components, including someone who might commonly be called a "software developer". In addition, anyone who initiates specifications or requirements for software or who procures product development/manufacturing services from other individuals or entities for subsequent commercial distribution is a software manufacturer. This term does not include a person or entity who solely distributes or markets software or who provides a service for others to distribute or market software on the Internet.

Software module: A software module is a discrete element of a software application that performs a specific function upon request by the core software code or by another software module. Software modules are used as part of a software architecture as a means of partitioning specific sub-functions that, when combined in a larger package or "wrapper", create the software application. The specific functions performed by a software module can be analytical (e.g., calculating daily averages of medical device data) as well as procedural (e.g., using standard or proprietary protocols for transmitting and/or converting data streams).

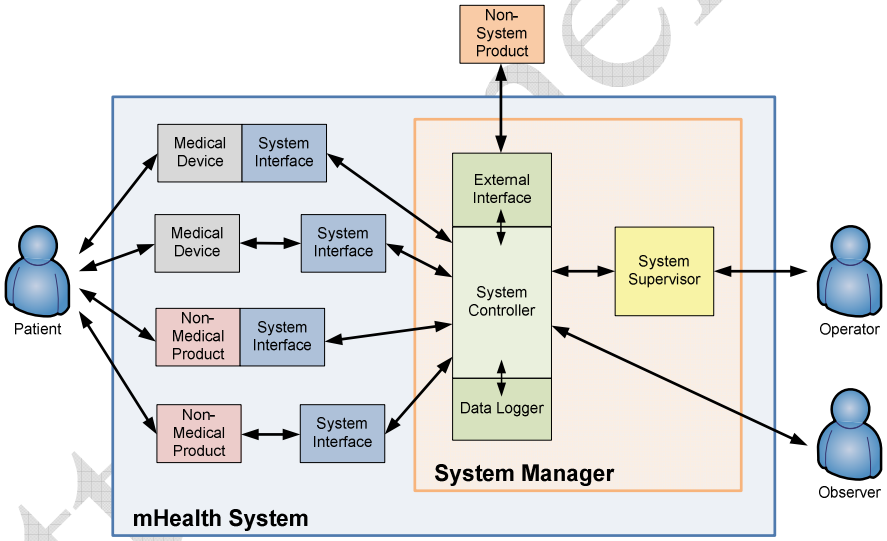
Wellness Data: Wellness data are consumer-specific, health-related information. Examples of wellness data include health information that is not medical data or that is generated by a consumer and/or a caregiver.

Wellness Advice: Wellness advice is a health-related recommendation that is provided via any mechanism to a consumer by a caregiver or by an individual who is not a health care professional acting in their professional capacity. An example of wellness advice is a recommendation by a person or company via a software or web-based program to increase exercise activity or reduce calorie consumption.

IV. Risk Model for mHealth Systems

The following mHealth System risk model has been developed based on ASTM F-2761-2009 *Medical Devices and Medical Systems—Essential Safety Requirements for Equipment Comprising the Patient-Centric Integrated Clinical Environment (ICE)—Part 1: General Requirements and Conceptual Model* and its adaptation to connected health technologies by the Medical Device Interoperability Safety Working Group (MDISWG).[12] The fundamental premise of the mHealth System risk model is that each stand-alone product should be classified (i.e., unregulated or Class I, II, or III) based on the risk associated with that specific product. By using standard interface protocols, each product can be evaluated without identifying, at the time of the regulatory review, the numerous devices that may be included in the mHealth System. Furthermore, any product that complies with these standard interfaces can be added or replaced (by a product with equivalent functionality and intended use) without affecting the risk profile of the system.[13] This risk model applies to both hardware and software in an mHealth system. Figure 1 illustrates a generic mHealth System and the potential connections between devices, non-device products, system controllers, and system users.

Figure 1: Illustration of a Generic mHealth System and the Various Components/Interfaces



[12] The ASTM F-2761-2009 standard "establishes the general principles for the design, verification, and validation of a model-based integration system that enables the creation of an integrated clinical environment intended to facilitate cross-manufacturer medical device interoperability." The standard embraces the concepts developed in ISO 14971, IEC 60601-1, IEC 62304, and IEC 80001. The focus of the ASTM standard is "for the care of a single high acuity patient." The Medical Device Interoperability Safety Working Group (MDISWG), part of the broader Medical Device "Plug-and-Play" (MD PnP) Interoperability program, adapted the terminology and requirements of the ASTM standard for use in any interoperable health care environment. Separately, Sandy Weininger (Sr. Electrical Engineer at FDA's Center for Devices and Radiological Health) in conjunction with Michael Robkin (President, Anakena Solutions and technical lead for the NIH Quantum Grant for medical device interoperability), are working to develop a risk model for interoperable medical device systems. We are adapting the ASTM standard and MDISWG's work products for use with mHealth systems. Furthermore, we reference and support the work of Sandy and Michael as a basis for evaluating risk in an interoperable mHealth system.

[13] This concept extends to software modularization, discussed in Section VII.F.1 of this guidance document.

A. General Risk Assessment

Generally, the level of FDA regulation of medical devices is determined by the overall risk associated with the device. Overall risk is a function of inherent product risk and ambiguity in the claims terminology. Inherent product risk associated with a specific mHealth product is determined by evaluating the likelihood of an adverse event to the *patient* or *consumer* and the severity of harm from that event on the individual's well-being. Table 1 describes the generic inherent risk chart based on the following definitions of likelihood and severity.

Likelihood can be defined as:

- *Improbable:* so unlikely to occur that it can be assumed that this hazard will not occur.
- *Remote:* unlikely to occur but possible.
- *Occasional:* likely to occur sometime in the life of the product.
- *Probable:* likely to occur more than once in the life of the product.
- *Frequent:* likely to occur several times in the life of the product.

Severity can be defined as:

- *Negligible:* will not result in injury or illness to the patient or user; no damage to the user environment (e.g. physical, contamination, EMC).
- *Minor:* could result in minor injury to the patient or user; little or no damage to the user environment.
- *Moderate:* could result in moderate injury or illness to the patient or user; may cause moderate damage to the user environment.
- *Major:* could result in death or serious injury or illness to the patient or user without intervention; may cause significant damage to the user environment.
- *Catastrophic:* could result in death to more than one patient or user; may cause severe damage to the user environment.

Table 1: Relationship Between the Likelihood and Severity of Risk in an mHealth System

Likelihood of Failure	Severity: Negligible	Minor	Moderate	Major	Catastrophic
Improbable	Minimum	Minimum	Minimum	Minimum	Low
Remote	Minimum	Low	Low	Low	Medium
Occasional	Minimum	Low	Medium	Medium	High
Probable	Minimum	Low	Medium	High	High
Frequent	Low	Medium	High	High	High

B. mHealth-Specific Risk Considerations

1. Influence of Product Functionality

For specific products within mHealth Systems, inherent risk may be influenced by evaluating the specific functionality of the product. The categories of functionality involved in mHealth systems include:

- *Data display:* representation of data (including alarms) generated by the various products in the system.
- *Generation of alarms:* creation of alarms based on data generated by the various products in the system.
- *Virtual control:* commands that allow control of specific products in the system by other products in the system.
- *Automatic control:* control commands automatically initiated according to pre-determined thresholds or algorithms based on data generated by the various products in the system.
- *Programming control:* clinician-established algorithms that control specific activity of any of the various products within the system.

2. Other Influential Factors

Additional factors that should be considered when determining the inherent risk of a specific product include:

- Intended use of the product as demonstrated by the claims and design features;
- The level of involvement of the consumer, a caregiver, and/or a health care professional in the proper use of the product;
- The degree of data analysis performed by the product or the product's underlying system;
- The level of involvement of the product's manufacturer or a third party in communicating results of the product's function to the consumer, patient, caregiver, or health care professional;
- The degree of influence the use of the product will have on clinical decisions by a health care professional;
- The need for immediate review of the product's results; and
- The potential for significant harm associated with the product's failure.

The greater significance of these factors in the product, the greater the inherent risk involved. Table 2 illustrates the degrees of risks for each of these risk factors.

Table 2: Risk Factors in mHealth Systems and Examples of Degrees of Risk[14]

Risk Factor	Degrees of Risk ← Less Risk		More Risk →
Intended Uses	Consumer uses	Disease-specific uses	Life-sustaining uses
User Involvement	Personal monitoring	Health care professional long-term monitoring	Health care professional acute care
Manufacturer's Role	Device Assessment	Infrastructure/service provider	Clinical evaluation
Data Analysis	Displaying data	Evaluating data via predictive algorithms	Triggering alerts/notifications
Role in Clinical Decisions	No role; personal use only	Informative; limited data points among many	Essential; only data source
Acuity of Results	Long-term monitoring only	Short-term monitoring, but not real-time	Real-time monitoring
Significance of Failure	Minimal harm	Reversible, physical injury possible	Irreparable, physical injury

a) Human Intervention

One factor that influences the risk associated with an mHealth system is the level of involvement of the consumer, a caregiver, and/or a health care professional in the proper use of the product. As with other medical devices, hardware and software components in an mHealth system may or may not involve human interaction or intervention. Human interaction or intervention can be categorized into three types of activities:

1. **Manual data entry** – keyed entry of data that is stored, transmitted, analyzed, or manipulated in some other way by the software;
2. **Assessment of data** – visual assessment of data stored in, received from, analyzed by, or manipulated in some other way by an mHealth system; and
3. **Manual manipulation** – electronically generated data that is manually modified prior to or to facilitate assessment of the data.

Historically, FDA has generally believed that human intervention reduces the risk associated with medical devices. Based on the advancement of technology and the common use of electronically generated data, FDA is no longer focusing on the means by which the data is generated. FDA now believes that

[14] This table is not intended to describe the entire spectrum of degrees of risk for a given risk factor.

electronically generated data involves no more inherent risk than manually-entered data. In line with this thinking, a hardware or software device that requires, for example, manual data entry of personal health information or medical device data (e.g., a blood glucose measurement) should be viewed as having comparable risk as a similar device that automates these activities. On the other hand, an mHealth system that involves human intervention as an intermediate step (e.g., by the product's manufacturer) between data generation (manual or automatic) and assessment (e.g., by a health care professional) should be viewed as having additional risk when compared to a system that directly transmits the data to the end user.[15] An intermediate step that has no effect on the assessment (e.g., for billing purposes) should have no impact on the associated risk.

b) Relationship Between Hardware and Software

Software may involve additional risk as a result of the associated hardware. For example, a software app designed for use on a proprietary, wireless hardware device may involve less risk than the same software app that is designed for a general purpose smartphone because the general purpose smartphone involves features and functions that are not specific to the software app, but that may cause the software app to malfunction. A proprietary hardware device, on the other hand, should involve less risk because the design features are limited to the specific intended use and functionality of the software app.

A software app that uses a cloud computing platform should not be viewed as involving additional risk when compared to a software app that relies on a dedicated hardware device. More specifically, FDA believes that, if you compare two devices of a specific type, one device that executes a software app locally involves no more significant risk than another device that executes the same software app on a cloud server.[16] Compare, for example, an app that is designed to be executed on a smartphone with another version of the same app that is designed to be accessed and executed on a cloud server using the same smartphone. While the risks may be different, FDA does not believe that the risks are significantly greater in either of these situations.

3. Examples of Products and the Associated Risk Categories

As described above, risk assessment for a given mHealth product is dependent on a number of different factors. While it is difficult in this guidance document to evaluate risk for a specific product, the following are a number of examples that the Agency believes demonstrate varying degrees of risk. Examples of products that fall into the **low-risk category** based on these factors include:

- A software app intended to reduce the risk of heart disease by the promotion of exercise and/or a well-balanced diet through health coaching advice on a smartphone.
- A software app intended to reduce the risk of pregnancy-related disorders through the promotion of relaxation and stress management by playing soothing music on an MP3 player or radio.
- A proprietary hardware device and software app intended to enable self-monitoring of personal health or vital statistics.

[15] For mHealth systems that communicate information directly to the consumer, assessment of data by a health care professional prior to provision of the information to the consumer may reduce the associated risk (e.g., by modifying the behavior of the consumer who might otherwise have taken different action associated with greater risk).

[16] Other considerations (e.g., security and privacy) must be well-controlled.

Examples of products that fall into the **moderate- or high-risk category** based on these factors include:

- An activity sensor device and software app intended to alert a health care professional of deviations from prescribed exercise activity using system-analyzed data.
- A software app with predictive algorithms intended for use as a weight management device to monitor congestive heart failure.
- A pill-bottle sensor intended to alert a health care professional of the delivery of medication or other therapy.

C. Risk Considerations for Exemption/Exclusion Criteria

Section V describes specific exemption/exclusion criteria for low-risk devices. Additional risk criteria for eligibility of the exemption/exclusion within this guidance document include:

1. The risk associated with a potential failure of the product should be sufficiently attenuated in time between the use of the product and the onset of the health-related condition such that failure of the product would not be considered to have an immediate or long-term, cumulative negative effect on the consumers' health; and
2. The product should not be used for life-sustaining purposes or to diagnose or treat an immediately life-threatening condition.

V. Intended Use Claims

A. Socially Beneficial, Low Risk (SBLR) Devices

This section categorizes the types of claims associated with mHealth products with intended uses that technically fall within the definition of a medical device but that should not be regulated because their social benefit outweighs their inherent low risk. Regulation of SBLR devices would remove the potential benefit to public health that such devices will undoubtedly deliver. FDA believes that the claims associated with SBLR devices pertain to medical issues that are so well-resolved that inclusion of the product claim should be exempt from regulation because: 1) the claims serve as an essential and powerful educational tool for consumers to learn about the benefit of lifestyle and behavioral modification; 2) education is a proven method of effectively modifying human behavior; and 3) the nature of the SBLR claims will greatly improve public awareness and subsequent education on the benefits of proactively preserving health.

The purpose of this section is to establish criteria by which FDA would make a "not regulated" decision about a product with one of these types of intended uses. A "not regulated" decision can be achieved for products associated with at least two general categories of claims: 1) Impact Claims; and 2) Information Claims. These two categories of claims are not mutually exclusive of each other and depend on the type of claim being evaluated. For example, a product may be considered "not regulated" based on the associated impact claims, yet be "regulated" as a result of the associated information claims.

1. Impact Claims: Criteria for Exemption

Impact Claims include statements that suggest the product can: 1) "reduce the risk of" a particular disease or medical condition; or 2) "improve" or "maintain" a particular aspect of an individual's health or medical condition. To be eligible for this exemption, the Impact Claim must meet each of the following:

1. The claim is a generally recognized health claim and not a disease claim;
2. The claim language is adequately qualified by *may*, *might*, or other similar language;
3. The mechanism by which the product functions to "reduce the risk of", "improve", or "maintain" the specified health-related condition does not involve invasive procedures.

Examples of Impact Claims include:

- "A software app that may reduce the risk of heart disease by actively monitoring and trending exercise activity on a daily basis."
- "A cloud-based personal health storage system that may improve your quality of life by allowing friends and family to review your behavioral activities in order to support you in your effort to quit smoking."

2. Information Claims: Criteria for Exemption

Information Claims include statements that suggest the product is designed to: 1) "collect" or "aggregate" diagnostic information; 2) "capture" or "detect" changes in an individual's health or medical condition; or 3) "alert" or "notify" a consumer, patient, caregiver, or health care professional of a non-acute health or medical condition.

To be eligible for this exemption, the Information Claim must meet each of the following:

1. The information collected or analyzed must be either:
    a) Medical data that are manually or electronically collected and entered; or
    b) Wellness data;
2. The results of the function performed on the information must not be transferred to a medical device for further analysis or to control the medical device;
3. The monitoring and/or notification functions must be intended only for use by:
    a) A consumer or caregiver;
    b) A health care professional not acting in their professional capacity; or
    c) A health care professional performing record-keeping or non-acute monitoring activities; and
4. The condition that the product is intended to monitor and/or about which the product is intended to notify the consumer or caregiver must not warrant the involvement of a health care professional to actively monitor the person's medical condition.

The use of these data by a health care professional does not automatically exclude a product from this exemption. The determination depends on the manufacturer's claims as to the intended use of the data by a health care professional.

Examples of Information Claims include:

- "A sensor system and web-based software app to collect, monitor, and store sleep parameters (e.g., duration and frequency of REM and non-REM sleep, etc.) for review by a behavioral/health coach."
- "A sensor system and smartphone app for use by a school nurse to monitor and alert the user of allergens in the school cafeteria and/or air pollen/pollutants on the school playground."

B. Ambiguously Defined, Low Risk (ADLR) Products

FDA believes that certain wellness purposes fall outside of the definition of a medical device and, therefore, are excluded from (i.e., not subject to) regulation because either the product is not acting to diagnose, treat, or prevent or the associated wellness condition is not a disease. For products in the "gray zone", inherent risk should be considered.

The purpose of this section is to establish criteria by which FDA would make a regulatory decision about a product associated with one of these types of intended uses. To that end, this section categorizes the types of claims associated with products where it is unclear whether the intended uses fall within the definition of a medical device because of the ambiguity in the statutory language as applied to an mHealth product. The statutory definition of a medical device is "an **instrument**, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including any component, part, or accessory that is **intended for use in the diagnosis . . . , treatment, or prevention of disease**, in man or other animals."[17] The task here is to resolve the ambiguity in the interpretation of the statutory definition.

[17] Food, Drug, and Cosmetic Act, § 201(h), 21 U.S.C. § 321(h) (emphasis added).

In the mHealth space, the ambiguity involves the terms *diagnosis*, *treatment*, *prevention*, and *disease*.

These ambiguities result from the use of general language as well as degrees of interpretation of specific terms used in the claims. Below is an example of several claims and the associated sources of ambiguity.

Table 3: Examples of Claims that Create Ambiguity in Regulatory Status

		Statutory Language	
		Diagnosis, Treatment, or Prevention	**Disease**
Claims Language	**General Terms**	To help manage your health	To improve heart health not associated with a diagnosed condition
	Specific Terms	To remind a patient to take medication or to complete some aspect of treatment (e.g., attend a doctor's appointment)	To allow patients to perform cognitive/audio/visual/motor/ sensory challenges/games

To resolve these ambiguities, the decision-making process should consider risk associated with the intended uses and types of health-related conditions being targeted.

To be eligible for the ADLR exclusion, the intended use claim must not be a disease claim, as demonstrated by one of the following being true:

1. The condition for which the product is intended to be used is not a) specifically identifiable, or b) a specific disease recognized by the American Medical Association or similar medical professional organizations (e.g., general health, weight, pain/discomfort, stress, stress-related hair loss, etc.);
2. The intended use of the product targets behavioral activities (e.g., exercise, sleep, nutrition, relaxation, smoking cessation, play games, etc.) not generally associated with a specific disease; or
3. The product is intended for use by a caregiver and/or a consumer.

In addition, this exclusion requires that:

1. For products that involve a health care professional, the product must not be intended for real-time or daily monitoring purpose of behavioral activities that are specifically identified to diagnose, prevent, or treat a disease. An example of a product that would fall outside of this exclusion is a product intended to allow a health care professional to monitor daily exercise activity of a patient being treated for morbid obesity.
2. For products that involve the exchange or display of patient health information, the product must not be intended for review by a health care professional as a means of diagnosing, treating, or preventing a disease or medical condition.

Health claims for products that are eligible for exclusion may include certain terms that distinguish the

intended use from that of a disease claim, such as those listed in Figure 2.

Figure 2: Example "Health" Terms that Should Not Automatically Trigger FDA Regulation[18]

• Health, wellness or well-being	• Stress or stress management
• Satisfaction or happiness	• Hospitalization
• Heart health	• Challenge or game
• General health	• Personal use
• Overall health	• Non-diagnostic-quality
• Unhealthy	• Sleep deprivation

Examples of ADLR claims include:

- "A tablet and web-based software app that provides mind challenging games and tracks scores and other parameters for review by a life coach for the elderly."
- "A SMS text system that provides daily motivational tips to reduce stress and promote a positive mental outlook."

C. Decision-Making Process

This section describes the approach that FDA recommends in order to determine whether a particular mHealth product is regulated based on its intended use claims. The process results in a determination that a product, based on the intended use claims, either is regulated or not regulated by FDA. If regulated, FDA intends to indicate to what extent the product is regulated based on existing classifications.

The two categories of products require separate decision-making processes. The existing 513(g) process can resolve the ADLR Product claims because the existing process allows FDA to make a determination as to whether the product is a medical device based on information provided by the manufacturer. The existing 513(g) process does not help to resolve the SBLR Device claims because 1) the information collected in the process is not sufficient to making the kind of judgment that needs to be made, and 2) these claims technically meet the literal definition of a medical devices and, therefore, the result of the 513(g) determination would always be that the product is regulated. FDA must be able to exercise enforcement discretion for those claims that pose little risk and for which it is in the public interest to not regulate. The additional information required to convert 513(g) into a process that covers SBLR Device claims will likely overburden the process, making review of ADLR Product claims more difficult.

[18] This list is not exhaustive; instead, these are examples to demonstrate the general principle that references to general health or personal wellness do not per se constitute disease claims.

1. Review of ADLR Product Claims

FDA will generally use the 513(g) process to resolve ADLR Product claims because the existing process results in determination as to whether the product, based on the information provided, is a medical device subject to agency regulation. If the product is determined to be a medical device subject to regulation, FDA will generally provide the following information consist with the current 513(g) process:

1. The generic type of device (e.g., classification regulation) (if any) that applies;
2. The Class within that generic type of device (and if more than one Class within that generic type, the particular Class that applies);
3. Whether a guidance document has been issued regarding the exercise of enforcement discretion over the particular Class of devices within that generic type; and
4. Whether additional requirements apply.[19]

2. Review of SBLR Device Claims

FDA will generally use its authority to make product-specific determinations regarding enforcement discretion. Enforcement discretion should be based on the criteria established above and, therefore, should be based on evidence that the product meets these criteria. In addition, risk may be determined based on a "primary mode of action" approach, whereby the significance of the wellness or non-medical purposes of the product weighs in favor of enforcement discretion for products that do not clearly meet the criteria above but are sufficiently low risk to warrant the exercise of enforcement discretion.

The manufacturer should submit specific information, including:

1. A product description and concise summary of the product's uses;
2. Samples of proposed marketing materials (e.g., instructions and other reference guides);
3. Evidence that the appropriate criteria are met; and
4. A recommended determination.

FDA will generally issue a confidential letter to the manufacturer within 60 days of receipt of the request for determination.

[19] CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICAL EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., DRAFT GUIDANCE FOR INDUSTRY AND FDA STAFF: FDA AND INDUSTRY PROCEDURES FOR SECTION 513(G) REQUESTS FOR INFORMATION UNDER THE FEDERAL FOOD, DRUG, AND COSMETIC ACT 4 (2010), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM209851.pdf.

VI. Accessories

In the future, everything that produces or receives medical device data, whether therapeutic or diagnostic, is likely to be connected to a network. So, for example, a blood glucose meter will be connected to a cell phone, which will connect to a cell tower, which will connect to a local area network, which will connect to a server, which will dump data in an EMR, which a physician will view on a tablet or smartphone.

Historically, the "accessory rule" has been thought of as an overarching rule, broadly applicable to nearly all so-called *parent device-accessory* connections. Under that rule, in certain situations,[20] FDA regulates a product that is an "accessory" to a medical device as if in the *same regulatory classification* as the "parent" medical device. The theory has been simply: if an accessory malfunctions, the risk to the patient would be the same as if the parent medical device malfunctioned. So, for a modern example, take an EMR that is indirectly connected to a blood glucose meter by way of three other low-risk Class I medical devices that are interconnected and passing data among one another. If one of those devices ultimately connects to the glucose meter, the EMR receiving data from the Class II blood glucose meter would receive a Class II designation—as would the other medical devices in this example. This results in regulatory excess, as harmless widgets would obtain the highest regulatory scrutiny just because they utilize data from a medical device with a higher classification.

The developing mHealth industry has raised significant questions about the scope of the accessory rule, due to the inherent interconnectedness of mHealth products. These questions are likely to become more complicated, as many products will be marketed in the future with broad system claims, rather than one-to-one pairing claims. This section describes FDA's current thinking on the regulation of traditional accessories in an mHealth system.

A. Policy Overview

Instead of deriving the regulatory classification from the data-generating parent device, FDA proposes a different conceptual approach, with two key prongs:

1. FDA intends to publish classification regulations for commonly used accessories. Much like with FDA's recent MDDS rule, the purpose here would be to establish more appropriate, risk-based classifications specific to the accessories that make up the various "families" within the family tree of connected products. The specific classification that defines a generic family of accessories should trump any classification derived from the data generator within a given tree.
2. FDA intends to regulate claims of compatibility between accessories in a family and the data-generating medical devices (traditionally treated as *parent* devices) by requiring that the firm making the claim provide adequate support to underpin the claim. If the device made by the manufacturer making the claim is Class II or III, the claim substantiation would need to be included in the submission to FDA. The manufacturer making the compatibility claim will

[20] Generally, FDA regulates a product as an accessory to (and in the same classification as) a specific medical device when the manufacturer of the product intends for it to be used with that medical device or when the medical device manufacturer requires the use of the product (which is sold separately) with that medical device.

also need to have some assurance that the claim will remain true (e.g., by agreements between manufacturers, through its quality system, or by compliance with key standards).

The following sections describe this proposed policy in more detail.

B. Regulation of Accessory Devices in an mHealth System

Under the traditional accessory rule, FDA generally regulates an *accessory* as if in the same regulatory classification as the *parent device*. As described above, the Agency is modifying its policy to the regulation of accessories. The fundamental concept is that the accessory rule applies if and only if there is not an existing classification for the device in question.

The first step for determining whether a product is subject to the accessory rule is to consider whether the product is a device at all based on the product's intended use. If it is not, the analysis ends because the accessory rule does not apply. If the product is a device, the next question is whether it meets an existing classification regulation based on its intended use.[21] If a device falls within an existing classification regulations, then the device will be subject to that classification and the relevant controls contained within the applicable section of the CFR.[22] To meet the definition of the classification regulation, the design and intended use of the device must not exceed the boundaries of the generic product type, including any applicable limitations (e.g., 8xx.9 regulations).

For those classification regulations that are exempt from 510(k) requirements, an mHealth device will remain exempt if the device:

1. Has existing or reasonably foreseeable characteristics of other devices in the classification category; and
2. Has the same intended use and fundamental scientific technology as another device in the classification category.

An mHealth device associated with an in vitro diagnostic device is subject to additional exemption limitations under the 8xx.9 regulations. In addition to the requirements above, an mHealth device of this type will remain in its existing classification regulation and exempt from 510(k) requirements if: 1) the

[21] When considering the appropriate classification of a new device, classification is evaluated by first determining whether FDA has previously classified and described a similar device type in the Code of Federal Regulations (CFR). The classification and descriptions of device types are organized by medical specialty panels in 21 CFR Parts 862 through 892.

[22] The existence of a regulatory classification of a medical device type is the agency's recognition that a given device type should fall within a specified device classification, even if that device happens to be an accessory or compatible with other devices. The medical device data systems (MDDS) Final Rule recognizes this fundamental principle of FDA regulation:

> If the product meets the definition of an MDDS because it is limited to the intended uses of an MDDS, FDA will regulate such a product as an MDDS, not as an accessory to or component of another device, regardless of how many particular devices or device types the product supports. FDA recognizes that some devices that meet the definition of an MDDS may have been previously cleared as accessories to other device types. Through enactment of this regulation, devices that are considered MDDSs will now be classified as class I, Exempt, whether they are existing devices or new/modified devices that are now defined as MDDS.

Medical Devices; Medical Device Data Systems, 76 Fed. Reg. 8637, 8644 (Feb. 15, 2011) (to be codified at 21 C.F.R. § 880.6310), *available at* http://www.gpo.gov/fdsys/pkg/FR-2011-02-15/pdf/2011-3321.pdf.

device is a low-risk device as determined by the intended use criteria described in Section V and under the risk model described in Section IV of this proposed guidance document; and 2) the device does not change the risk profile of the associated in vitro diagnostic device.

A low-risk mHealth device is not *per se* restricted from exemption under the 8xx.9 limitation, even if the intended use is any of the following:

1. For assessing the risk of cardiovascular disease;
2. For use in diabetes management;
3. For identifying or inferring the identity of a microorganism directly from clinical material; or
4. For near-patient testing (point of care).

FDA intends to use the 8xx.9 limitations judiciously and not to exclude a product from a classification regulation simply because that product connects to another medical device in an mHealth system or the product at issue has different characteristics than other devices. In determining whether the 8xx.9 regulation will exclude a device from a classification, a manufacturer should conduct a risk assessment. If the risk assessment supports the Class I or II exempt classification, the device should remain within the boundaries of the existing classification.[23]

If the device does not fit within an existing classification, the device manufacturer may avoid the accessory rule by requesting that FDA determine the device classification through the *de novo* review process. The *de novo* review process is an opportunity for a device automatically designated as Class III to be reclassified as a Class I or II device, if appropriate.[24] Applicants should support their *de novo* submission by a risk assessment that demonstrates the lower risk profile of the device.[25] FDA or any stakeholder may also employ any other available route to reclassification.

If the device manufacturer does not pursue the *de novo* review process (or any other form of reclassification) and the device is intended to be used with another medical device in an mHealth system, the device becomes an accessory and takes on that device classification of the other medical device.[26]

If the device is not intended to be used with another medical device in an mHealth system, the device is not an accessory and, instead, will be automatically subject to a premarket approval submission as a Class

[23] Appendix A of this document lists current regulatory classifications that are useful for mHealth accessories. Appendix B suggests classifications that FDA should consider for future development.

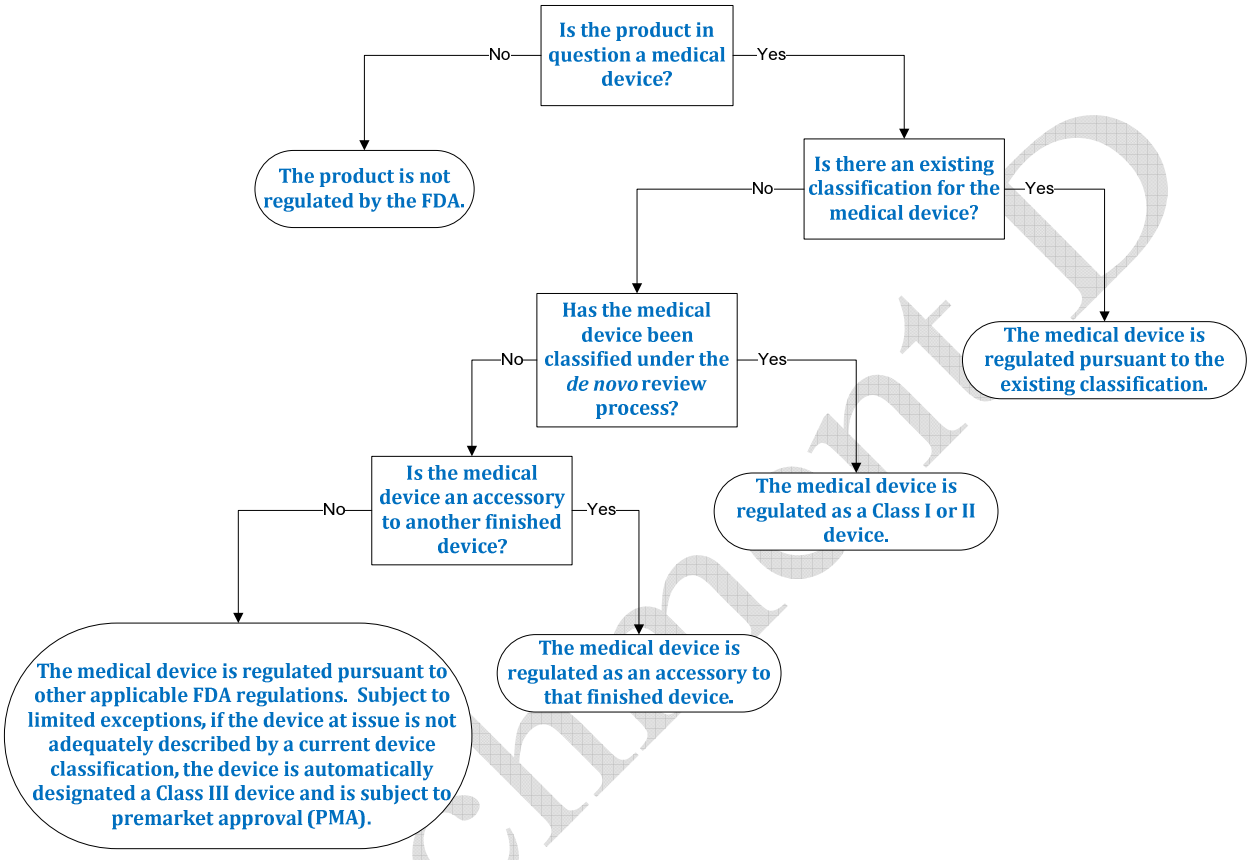
[24] A device manufacturer may petition FDA to regulate the device as a Class I or II medical device independent of the other products in the mHealth system. The *de novo* process, established in § 513(f)(2) of the Federal Food Drug & Cosmetic Act, is particularly appropriate for low risk devices. The *de novo* process will be useful for mHealth devices and the creation of needed regulatory classifications. FDA should use this process more frequently for mHealth products to create consistency and predictability in the regulation of mHealth devices.

[25] The existing guidance on the *de novo* process also should be used to guide application content; however, FDA should include specific guidance for mHealth products in the guidance on the *de novo* process.

[26] Inherent in this analysis is the assumption that the device is a finished product rather than a *component* to another finished product. The difference between an accessory and a component is important because it determines the applicable regulatory requirements for a particular product. Components are exempt from most FDA regulatory requirements, with the regulatory burdens being borne by the finished device manufacturer. Accessories, on the other hand, because they go right to the end user, must meet the FDA requirements before they leave the hands of the accessory manufacturer.

III device.[27] Figure 3 summarizes this analysis.

Figure 3: Framework for Regulation of Accessories in an mHealth System



C. Claims of Compatibility

A claim of compatibility between two medical devices in an mHealth system does not render a parent device-accessory relationship between the two products. The analysis described above determines whether a device is an accessory. The claim of compatibility, however, must be substantiated through adequate validation.

Take, for example, a weight scale (and an associated software app) that claims compatibility with a specific brand of blood glucose meters. The scale is not regulated as an accessory to the blood glucose meter because the scale has its own classification.[28] However, the manufacturer of the scale must validate its claims of compatibility with the blood glucose meter. If the manufacturer of the blood glucose meter claims compatibility with the scale, the manufacturer must validate that its blood glucose meter is compatible with the scale. The burden lies on the manufacturer making the claim of compatibility to substantiate the claim through adequate validation.

[27] Appendix C describes other considerations that may impact this analysis.
[28] The scale is regulated as a Class I device under 21 C.F.R. § 880.2700. The blood glucose meter is regulated as a Class II device under 21 C.F.R. § 862.1345.

FDA should also consider using a feasibility test to determine the significance of the validation. If it is feasible for the manufacturer (at the time the product is created) to self-assess the product as a low-risk device, the validation requirements should be minimal.

Claims of compatibility should be substantiated to demonstrate that the associated risk is recognized and minimized. Even though a lower-class device is not up-regulated, the claim substantiation process ensures the risk associated with the two products is low. Claim substantiation is separate and apart from the determination of whether a device is an accessory or its appropriate classification.

Claim substantiation requires both present and future validation by the claim maker.[29] Present substantiation consists of validation testing to ensure that the claim of compatibility is accurate and to clarify the design specifications that support the claim. Future substantiation consists of the establishment of a quality system and on-going validation testing whenever changes to either article are made. This may involve either control of the design of both devices (e.g., by ownership) or an agreement between the claim maker and the manufacturer of the product that design specifications will not change or that notification will be given in advance of any changes to allow the claim maker to adequately address the impact of such changes on the future substantiation of the claim. In the absence of such an agreement, the claim maker would need to assess the risk to show that an agreement is not necessary.

[29] Some types of device relationships trigger additional regulatory obligations. Appendix D describes three scenarios that demonstrate the degrees of regulatory obligations that may arise.

VII. Software

Software is of particular importance to mHealth technologies because the data collected by sensors, wireless medical devices, and other physical products—most of which have their own internal software—are being stored, analyzed, and routed by software apps. It is common in mHealth systems that these functions are conducted remotely across interconnected networks via local networks and the Internet. As with any other product, FDA regulates software if an app meets the definition of a medical device.

Software in the mHealth world can come in all shapes and sizes and can perform a variety of functions. Although software is purely non-physical, association with a tangible piece of hardware is required at some point throughout the web of interconnected hardware technology comprising the mHealth system. Software can be found in any of the following mHealth system components:

1. Medical devices;
2. Patient-centered communications technologies;
3. Provider-centered communications technologies;
4. Intermediary-centered communications technologies; and
5. Network infrastructure technologies.

Software in a medical device can come in two forms: the first is called *firmware*, while the second uses the generic *software* term. Software also can be found outside of the medical device and at any point along the information pathway from the patient to the health care professional.

Patient-centered communications technologies (e.g., a personal computer, smartphone, tablet, or proprietary communications device) can utilize software to perform analytical tasks or to control the transmission of patient data.

Provider- and intermediary-centered communications technologies may be any of the same types of communications technologies used by the patient but instead are used by a health care professional or a third-party intermediary. These technologies can employ any of the types of software that are designed for patient use. The software also could be used for the same or different purposes as the patient-centered devices.

The network infrastructure of an mHealth system can include any number of servers, mainframe computers, data storage devices, wireless routers, and telephone service switches, among other things. These products are distinct from the patient-, provider-, and intermediary-centered communications technologies in that the network infrastructure technologies function independently of the other technologies and require no involvement from the patient, clinician, or intermediary. Software that resides on these components may or may not be specific to the mHealth system.

The software, however, need not "reside" on a network infrastructure component in the way that software is traditionally downloaded onto a computer. Cloud computing, which is becoming more common in the consumer marketplace as well as the mHealth sphere, distributes software algorithms and functionality over a number of different networked hardware components. The fluidity of this type of software system is technically powerful, promoting advanced algorithmic capabilities but makes identifying where the software "resides" increasingly difficult. Similarly, aspects of software that once were bundled in a specific software program are now being "outsourced" across the Internet to various developers who

provide "software services". These software services perform standard functions (e.g., a search or payment function) across the network infrastructure and separate from any specific mHealth component.

A. General Approach to Software Regulation

Software is treated in the same way that other products are treated for purposes of determining whether and how FDA would regulate. Any software that does not meet the definition of a medical device is not regulated by FDA. Therefore, to be considered for regulation, the software product must be intended by the manufacturer for use in the diagnosis, treatment, or prevention of disease according to 201(h) of the Federal Food, Drug, and Cosmetic Act (FD&C Act).[30] Refer to Section V of this guidance document for further discussion of the intended use analysis for mHealth products.

Any software device that falls into an existing classification regulation should be subject to the regulatory requirements established in that classification regulation. If no classification regulation exists, the software device may be evaluated under the de novo review process for classification purposes.[31]

Any software device that meets the definition of an accessory should be regulated based on the accessory framework described in Section VI of this guidance document. Software apps that are intended to be purchased by a manufacturer of the finished device in which the product will be incorporated should be treated as components. The software manufacturer of a component software app should not be regulated by FDA unless the app is sold as a reusable software module or to an end user as a replacement part.

The manufacturer of a finished software device, however, should be subject to regulation appropriate for the finished device. Any software device that is not an accessory or a component and that is not adequately described by an existing classification regulation or has not been evaluated under the de novo review process (or some other approach to reclassification) should be a Class III device subject to premarket approval requirements.

A software manufacturer must comply with all applicable regulations, including the Quality System Regulations (21 C.F.R. Part 820), premarket notification/approval submissions, establishment registration, and product listing, as are appropriate for the designated device classification.[32]

[30] Products that are built with or consist of hardware and/or software components or applications are subject to regulation as devices when they meet the definition of a device in section 201(h) of the FD&C Act. That provision defines a device as "an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent . . . " that is "intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man . . . or . . . intended to affect the structure or any function of the body of man or other animals . . . ." 21 U.S.C. § 321(h). Thus, software applications that run on a desktop computer, laptop computer, remotely on a website or "cloud," or on a handheld computer may be subject to device regulation if they are intended for use in the diagnosis or the cure, mitigation, treatment, or prevention of disease, or to affect the structure or any function of the body of man. The level of regulatory control necessary to assure safety and effectiveness varies based upon the risk the device presents to public health.

[31] Appendix A lists the current classification regulations and associated product codes that may apply to software in an mHealth system. Appendix B presents a number of proposed classification regulations that should be implemented to adequately address regulation of mHealth software.

[32] Software that is manufactured outside of the United States is subject to FDA regulation if the manufacturer intendeds for its product to be marketed in the United States.

B. Unregulated mHealth Software

Software that falls into the ADLR Product exclusion does not meet the definition of a medical device and is not subject to FDA regulation. See Section V.B for a description of the ADLR Product exclusion. Examples of ADLR Products include:

- Software that alerts a caregiver of a low-risk health event because the product does not diagnose, treat, or prevent a specifically identifiable disease or medical condition and is intended for use by a caregiver.
- Software that facilitates the monitoring of behavioral activities or basic health information (e.g., food consumption, weight trends) to evaluate general wellness of an individual because the product does not diagnose, treat, or prevent a specifically identifiable disease or medical condition and is intended to target behavioral activities not generally associated with a specific disease or medical condition.
- Software that helps a consumer manage personal health information because the product does not diagnose, treat, or prevent a specifically identifiable disease or medical condition.

FDA believes that there are a number of software devices for which the associated risk is sufficiently low that regulation is not warranted. At this time, FDA is choosing to exercise its enforcement discretion for these software devices that are part of an mHealth system. FDA reserves the right to reevaluate any enforcement discretion decision.

Software devices that meet the SBLR Device exemption (described in Section V.A) or that have any of the following functions fall into this unregulated category:

- Automates a function for ease-of-use;
- Performs library functions;
- Stores or transmits personal health information in EMR, EHR, or PHR systems;[33]
- Analyzes for non-diagnostic purposes personal health information stored in an EMR (or other similar EHR or PHR system); or
- Performs general IT functions[34] or business functions (i.e., general purpose articles).

[33] FDA is currently exercising its enforcement discretion, but is considering several possible approaches to regulation of EMRs, including:

> 1) Focusing on post-market safety by requiring HIT device establishments to electronically register and list their HIT devices, and to submit Medical Device Reports (MDRs) to the FDA;
> 2) Focusing on manufacturing quality and post-market safety by requiring HIT device manufacturers to comply with the above requirements and also to adhere to FDA's Quality Systems Regulation (QSR); and
> 3) Applying the traditional regulatory framework, in which HIT device manufacturers would be required to meet all the same regulatory requirements as other, more traditional devices, including risk-based premarket review.

Testimony of Jeff Shuren, Director of Ctr. for Devices & Radiological Health, U.S. Food & Drug Admin., before the Adoption/Certification Workgroup of the HIT Policy Committee (Feb. 25, 2010), *available at* http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_11673_910717_0_0_18/3Shuren_Testimony022510.pdf.

The intended use and design functions of these software devices must not exceed the functional limits described here. Examples of software devices that should remain unregulated at this time include:

- Software that sends notifications to a patient to take a pill or to remind them to visit their health care professional because such software automates a function of the health care professional or caregiver for ease-of-use.
- Software that prompts the consumer to answer pre-determined, health-related questions because such software performs library functions typically associated with the activities of a health care professional or caregiver. Similarly, software that transmits this information to a health care professional or caregiver in a report is unregulated because such software automates the report-writing and record-keeping function of a health care professional or caregiver for ease-of-use. The location where the software executes or is used (i.e., on a device in the consumer's home or a health care professional's office, on a third-party cloud server) does not affect the regulatory status.
- Software that stores or transmits personal health information (e.g., EMR, EHR, or PHR software) even if automatically obtained from a Class I medical device (e.g., data obtained from an electronic blood pressure cuff). More specifically, EMR software that stores or transmits (e.g., to another EMR software system) personal health information (including data from a Class I device, e.g., blood pressure measurements) is unregulated such that once the information enters the EMR software, it can be stored and transmitted freely throughout the EMR system and to other EMR systems without triggering FDA regulation. Similarly, software that allows an individual to manually enter personal health information (including medical device data) is unregulated.
- Software that calculates and graphically displays trends in personal health incidents (e.g., hospitalization rates or alert notification rates). Similarly, software that generates a report based on data stored in an EMR, EHR, or PHR system is unregulated.
- Software that controls the equipment used to communicate health-related information from one location to another because such software performs general IT functions.
- Software that allows a "face-to-face" high-definition (HD) video conversation with a health care professional if marketed as a general purpose IT product.
- Software that monitors a consumer's use of the mHealth system for billing purposes because such software performs a general business function.

As with any product, software that does not meet the definition of a medical device is not regulated as a software device. Examples of products that do not meet the definition of a medical device and could be easily confused with regulated software devices include:

- Software that stores, analyzes, and transmits calorie consumption and/or exercise activity for personal use.

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[34] This exemption applies to a general purpose IT product that is used in an mHealth system and that is not altered or reconfigured outside of its manufactured specifications. Modifications within the off-the-shelf parameters of operation are still considered exempt.

- Software that provides educational information related to medical diseases or conditions.
- Software that provides educational information, advice, or motivational guidance related to behavioral activities that may be associated with a medical disease or condition (e.g., to help quit smoking or to improve medication compliance).
- Software that allows "face-to-face" HD video conversations (or other means of communication, e.g., instant messenger, email, SMS text, etc.) between a consumer and a caregiver.
- Software that allows a patient or health care professional to manage administrative activities associated with the delivery of health care (e.g., electronic appointment scheduling, prescription writing/filling, billing, etc.).
- Software that allows a consumer to play "mind challenging" games.
- General communication software that are used for telecommunications purposes to transmit data in an mHealth system and that comply with applicable standards for such products. These include wireless routers, modems, switches, Bluetooth transmitters/receivers, cables, connectors, adaptors, and any other similar product used for connectivity purposes. This also includes software drivers and accessories associated with the basic functionality of these devices.
- General purpose health applications that are used in an mHealth system to electronically collect, store, transmit, display, or analyze (e.g., trend, aggregate, or generate reports) health-related data for educational purposes or as a tool to affect normal behavioral activity (e.g., food consumption or exercise activity). An example of a general purpose health application is a software device stored on a smartphone that electronically collects daily exercise and weight information from a variety of sensors and displays the data for personal monitoring purposes.

C. Class I Exempt mHealth Software

FDA believes that certain software devices have sufficient risk associated with their intended use that enforcement discretion is inappropriate; however, there also exist a number of software devices for which general controls will adequately address the associated risk. FDA intends to regulate these software devices as Class I devices exempt from premarket notification requirements.

Software devices that meet any of the following should be Class I exempt from premarket notification:

1. Firmware associated with a Class I exempt medical device;
2. Software that falls into an existing Class I exempt regulation (e.g., medical device data systems (MDDS) under 21 CFR § 880.6310, laboratory information systems (LIS) under § 862.2100, or medical image management systems (MIMS) under §§ 892.2010 and 892.2020) and that does not fall within the 8xx.9 limitations on exemption; or
3. Low-risk software that does not meet the SBLR Device exemption or ADLR Product exclusion criteria.

D. Class II or III mHealth Software

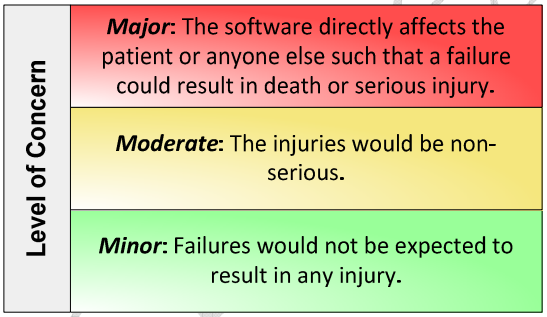
FDA believes that, for a number of software devices, the associated risk requires additional regulatory controls to ensure safety and effectiveness of the devices. These software devices are regulated as Class II or III devices.

FDA applies its long-standing Level of Concern and inherent risk analysis to determine the appropriate regulatory controls for the following:

- Firmware associated with a Class II or III medical device; and
- Software that falls into an existing Class II or III regulation as a stand-alone product, a component, or an accessory; and
- Software that does not fall into an existing classification but involves moderate to high risk.

The Level of Concern analysis focuses on the severity of an injury. The categories in which a given software device can fall is as described in Figure 4.

Figure 4: Definitions of Level of Concern for Software Risk Assessment



The Level of Concern analysis is independent of the device classification determination and is used to establish the depth and degree of hazard analysis and mitigation that is expected, the depth and degree of documentation, what needs to be submitted as opposed to simply documented, the rigor applied to the verification and validation of the software, and the degree to which the device manufacturer's software development process is scrutinized.[35]

Generally, the inherent risk analysis involves the likelihood and severity of an injury occurring. The association between inherent risk and the intended use forms the basis of the total risk. For software, however, FDA believes the focus should be on the severity of harm because likelihood of risk related to software cannot easily be estimated.[36]

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[35] CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICS EVALUATION & RESEARCH, U.S. FOOD & DRUG ADMIN., *supra* note 10.

[36] CTR. FOR DEVICES & RADIOLOGICAL HEALTH, U.S. FOOD & DRUG ADMIN., GUIDANCE FOR INDUSTRY, FDA REVIEWERS, AND COMPLIANCE ON OFF-THE-SHELF SOFTWARE USE IN MEDICAL DEVICES 2 (1999), *available at* http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073779.pdf; CTR. FOR DEVICES & RADIOLOGICAL HEALTH & CTR. FOR BIOLOGICS EVALUATION & RESEARCH, *supra* note 10, at 17.

E. Categories of mHealth Software

At a high-level, mHealth software can be broken into the following three product types:

1. Hardware drivers and software accessories;
2. Communication device apps; and
3. Stand-alone and web apps.

For each of the product types, a software product can fall into any of the following classification categories: Class II or III; Class I (exempt from premarket notification); or unregulated software. The following describes each of the product types in more detail with examples of software and their associated classification category.

1. Hardware Drivers and Software Accessories

Generally, software that fall into this product type includes firmware or other device controllers (e.g., operating systems). Class II or III devices that fall into this product type include:

- Firmware for a Class II or III device (e.g., blood glucose meter or pacemaker);
- Software that sends signals to a Class II or III device to control device operation (e.g., establishing a set-point for a control parameter or "waking up" the device).

Devices that are Class I exempt from premarket notification and that fall into this product type include:

- Firmware for a Class I device (e.g., MDDS or weight scale);
- Software that sends signals to a Class I device to control device operation (e.g., establishing a set-point for a control parameter or "waking up" the device).

Unregulated software products that fall into this category include general purpose device operating systems.

2. Communication Device Apps

Generally, software that fall into this product type receives and/or transmits data (e.g., a smartphone app). Class II or III devices that fall into this product type include a smartphone app that is intended:

- To alert a health care professional or emergency service of a moderate- or high-risk medical event;
- To facilitate real-time diagnosis or treatment; or
- To facilitate monitoring patient activity associated with a moderate- or high-risk disease.

Devices that are Class I exempt from premarket notification and that fall into this product type include:

- MDDS software (21 CFR § 880.6310);
- MIMS communication software (21 CFR. § 892.2020);

- A smartphone app intended to alert a health care professional of a low-risk medical event or to facilitate monitoring patient activity associated with a lower-risk disease.

Unregulated software products that fall into this category include:

- A smartphone app intended to alert a caregiver of a low-risk health event, or to facilitate monitoring activity to evaluate general wellness.
- Apps that perform general IT functions (e.g., e-mail or SMS text messaging).

3. Stand-Alone and Web Apps

Generally, software that fall into this product type perform data analysis (e.g., for professional decision support or personal health management). Class II or III devices that fall into this product type include PC-, smartphone-, or web-based apps intended:

- To analyze patient data for medical diagnosis or treatment;
- To allow a health care professional to monitor Class II or III device data or patient activity for diagnosis or treatment of a moderate- or high risk-disease; or
- To track and report activity for treatment of a moderate- or high-risk disease.

Devices that are Class I exempt from premarket notification and that fall into this product type include PC-, smartphone-, or web-based apps intended:

- To allow a health care professional to monitor Class I device data or patient activity for diagnosis or treatment of a low-risk disease; or
- To track and report activity for treatment of a low-risk disease.

Unregulated software products that fall into this category include PC-, smartphone-, or web-based app intended:

- To manage personal health information;
- To track, display, or report basic health information (e.g., daily/monthly exercise activity, food consumption, weight trends, etc.) to evaluate general wellness;
- To automate manual office and/or record-keeping functions (e.g., EHRs).

F. Other Considerations

1. Software Modularization and Reusable Software

It is possible—in fact, quite probable—that a single software product may involve functionality that places it in more than one of these product types. Under the current regulatory approach, in the event that a software product involves different product types and classification categories, the highest classification would apply. Alternatively, the software manufacturer may choose to separate these functionalities so that a single product type is applicable. To achieve this modularization, each software functionality could be marketed as separate products with the specific intended use described in one of the product types and associated classification categories. As yet another alternative, the software manufacturer may choose to separate the software app such that specific modules that fall into a lower classification or that are

unregulated and unaffected by functionalities that fall into a higher classification.

While the traditional boundaries for software development are currently being broken, FDA recognizes that software in the mHealth system of the future may involve modules developed from a variety of sources and based on novel architectures. In that way, the software would be much like a system of software that comprises a larger software product.[37] For example, a software product may be composed of multiple modules that are created by various manufacturers and that span a range of device classifications. Alternatively, the manufacturers may choose to independently market only specific modules rather than the entire app. These software units and subunits should be regulated based on the principles outlined in this guidance.[38]

When manufacturers employ the various software architecture standards described below, modules can be regulated independently from the rest of the app, so long as the module fits squarely within an existing classification.[39] FDA encourages the use of standard software design principles in the development of mHealth software and system architectures. Use of standard design principles reduces inherent risk and enables modularization of discrete functions within a software app (i.e., software modules) as well as within an mHealth system that involves more than one hardware or software element. FDA believes the use of software modularization principles will ensure that the entire product is not subject to unnecessary regulation.

a) Example of App-level Modularization

An MDDS device is an example of how data can be transmitted from one software app to another without affecting the regulatory status of either software app. Assume for this example that App A collects medical device data within a blood pressure cuff. App A transmits the blood pressure data to a separate software app (App B). App A is regulated based on its intended use (i.e., Class II under 21 C.F.R § 870.1120), while App B is regulated as a Class I exempt MDDS device (assuming for the sake of this example that App B fits squarely within the MDDS rule). Even though Apps A & B communicate and share information with each other, each is regulated independently. Use of standard design principles should ensure the inherent risk associated with each app and with the communication between each app is minimized. Apps A & B in this example need not be separate products. At a minimum, there should be separation in the software architecture such that the functions are independent (see example below).

The principle presented in this example should not be limited to MDDS devices. App B in this example

[37] The Agency recognizes that the term *app* may become obsolete over time. Nonetheless, the principles established in this guidance document should still apply.

[38] While portions of this guidance specify regulation at the app-level, the principles apply to any unit, subunit, or system of units. This guidance describes modularization at an app and sub-app level; however, the principles nonetheless apply at the level of a system of apps or any other unit or subunit.

[39] The FAA regulates *reusable software*, allowing for reuse of software such as a Global Positioning System (GPS). The FAA has used this approach in all types of aviation systems, including the highest risk classification. *See* FED. AVIATION ADMIN., U.S. DEP'T OF TRANSP., FAA ORDER 8110.49: SOFTWARE APPROVAL GUIDELINES 75–78 (2003), *available at* http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgOrders.nsf/0/640711b7b75dd3d486256d3c006f034f/$FILE/Order8110.49.pdf. According to FAA, if properly planned and packaged, software life cycle data (including software code) can be reused from one project to the next, with minimal rework. *Id.* at 75. For example, the software plans, requirements, design, and other software life cycle data may be approved on the original project and reused on subsequent projects. *Id.* By following similar planning and packaging methods, FDA can allow mHealth systems to reuse software modules that fit squarely within an existing classification and avoid unnecessary regulation of the entire mHealth system under the reusable module's classification.

could be replaced with other Class I devices or unregulated devices. The software modularization principle remains the same. It is important to note the distinction between firmware and software in relation to this principle. Firmware is the code that controls the basic functionality of a traditional medical device (e.g., controlling the timing of a pacemaker). The software modularization principle is not intended to apply to firmware. Instead, this principle applies to software used, for example, in mobile apps or a store-and-forward system that involves back-end software for use by a health care professional or some third-party intermediary.

b) Example of Module-level Modularization

Now consider a single software app that is designed using multiple software modules to perform discrete functions within the app. Module A receives and stores medical device data transmitted from a Class II blood pressure cuff. For the sake of this example, assume that Module A fits squarely within the Class I MDDS regulation. Module B compiles the blood pressure data into a trend graph and displays the trend upon request. If appropriate software design principles are employed in the development of the software app (including Modules A & B), the risk that Module B will influence Module A should be low, such that Module A should be regulated under the MDDS classification regardless of the fact that Module A is packaged in a software app that also includes non-MDDS functions in Module B. Module B should be regulated based on the risk associated with its functionality and intended use.

c) Approaches to Software Modularization

A variety of approaches can be used to achieve modularization of software such that 1) a single software app, comprised of software modules created by one or more manufacturers, can be separated into distinct device classifications based on the intended use of the discrete modules within the software app and 2) a single software app can be separated from other software apps not associated with the mHealth functionality (e.g., other software apps on a smartphone that perform non-medical functions and that are not intended to influence the mHealth system). These approaches include the use of:

1. Library standards (e.g., DLLs or COMs);
2. Privileged sections of controlled execution environments (e.g., for memory, task managing, etc.);
3. Other object-oriented programming approaches, including information hiding (i.e., protecting software components from external entities), decoupling (i.e., ensuring two separate software components are not tightly dependent on each other), and encapsulation (i.e., hiding inner workings of software component behind the public interface);
4. Harmonized standards for medical devices (e.g., IEC 62304 – for medical device software; IEC 60601 – for medical electrical equipment; IEC 61010-1 – for safety requirements for electrical equipment for measurement, control, and laboratory use; ISO 13485 – for medical device quality management systems; and ISO 14971 – for medical device risk management); and
5. Defensive programming techniques (e.g., input/output validation, error handling, memory management, and data management).

When using these approaches, the manufacturer(s) should, at a minimum, design the module such that it does not affect other modules within the app/system, create reusable modules for use across all intended

systems, and validate and verify the modules' performance in key scenarios.[40]

d) Environmental Considerations

FDA recognizes that the use of a software app on a platform (e.g., a smartphone) alongside other software apps that are not intended to function with the mHealth system involves some additional inherent risk that platform-based functions (e.g., communication protocols) may become affected by the non-medical app. FDA believes, however, that using standard software design principles for the mHealth app with standard off-the-shelf (OTS) platforms (e.g., smartphones, tablets, etc.) minimizes this risk. Compliance with ISO 14971 and the Quality System Regulation (21 C.F.R. Part 820) will further reduce this risk.

In some situations, the relationship between software and hardware is inseparable (e.g., device operating systems), while in others the software is not hardware-dependent (e.g., stand-alone software app). Where software cannot be divorced from the hardware on which it executes, the software should take on the classification of the hardware unless the software itself would result in a higher classification. Where the software is not hardware-dependent, the software should be regulated separately from the underlying hardware. More specifically, a smartphone that is intended for use in the execution of a software app should not by default be regulated at the same classification as the software app (or regulated at all) and vice versa. For example, a software app that allows the user to enter blood glucose readings and weight measurements and that transmits the data to the health care professional for monitoring of the patient's diabetes should be regulated as a Class II medical device. The smartphone on which the software app resides should not be regulated as a medical device (unless it otherwise meets the definition of a medical device).[41]

2. 8xx.9 Regulations

As with any medical device, software devices that are Class I exempt from premarket notification are also subject to the 8xx.9 regulation restricting the exemption to certain types of devices.

FDA recognizes the importance of creating a long-lasting regulatory framework for medical device software, particularly software apps used in an mHealth system. The rapid evolution of mHealth technologies and software system architectures poses a significant challenge. FDA intends to apply the following general principles to future technology to determine whether the technology is included in the scope of the current classifications and exemptions. A technology fits within an existing classification and any associated exemption if:

1. The new technology fits squarely within the wording of the classification regulation and any associated exemption, which was written with a focus on basic operating principles and intended uses rather than specific technology types; and
2. One of the following is true:
    a) The technology is reasonably foreseeable at the time the classification/exemption was created, as demonstrated by literature that existed at that time; or

[40] This concept is analogous to testing in the aviation industry of global positioning systems in different types of aircraft.

[41] Recall that, although a smartphone might not be regulated, the regulated software manufacturer would be required to validate claims of compatibility with the smartphone and comply with other guidance regarding security in software devices.

b) The technology advances since the creation of the classification/exemption do not create significant new risks that need to be evaluated.

One recent technological advancement that challenges the current regulatory framework is the use of cloud computing or "software services" to perform a discrete software function. Cloud computing challenges the current framework because functions that were once embedded in a single software app are now being "outsourced" to external servers and other platforms to take advantage of computing power and a diversity of resources. When functions (or entire apps) are outsourced to a cloud, it becomes difficult to identify where a fault may have occurred. A product that uses cloud computing would still fit within the existing classification regulation if the product remains squarely within the wording for the regulation and there are no new risks presented. Using standard software design approaches discussed for software modularization should minimize the inherent risk associated with cloud-based systems. More specifically, architectural frameworks for client-server systems, the simple object access protocol (SOAP) specification, representational state transfer (REST) designs, and extensible markup language (XML)-based methods may be useful to perform certain functions (e.g., to manage/exchange data, resources, access, or security). Risk assessment should focus on software implementation approaches and design controls rather than the platform on which the software performs its functions.

Another technological advancement that challenges the current regulatory framework is the use of over-the-air (OTA) software upgrades. OTA upgrades are used to rapidly disseminate product changes. Use of OTA upgrades should not affect the classification of the software app because the basic functionality of OTA upgrades is not substantially different from downloading an upgrade using traditional approaches (e.g., using a CD or DVD disk in a PC or connecting the device to the Internet via a telephone or cable modem). Some OTA product changes may be superficial (e.g., an app icon update), while others may have a significant impact on the functionality of the app (e.g., new features or patches for known software bugs). Even where OTA upgrades implement significant changes to the functionality of the app, not all changes involve the same level of risk. For example, an upgrade that affects a software module that does not perform a medical device function (e.g., a billing module) may involve a substantial change, but may not involve any risk to the medical modules within the app. Modularization approaches described above should be used to mitigate any risk to software modules that perform medical functions. Whether a product that uses OTA upgrades remains in an existing classification regulation will depend on the risk (i.e., whether the associated risks go beyond the scope of the generic device type). Ultimately, a software manufacturer must still comply with all applicable regulations, including design controls under the Quality System Regulations.[42]

[42] *See* 21 C.F.R. § 820.30.

VIII. Conclusion

This guidance document describes FDA's current thinking on regulation of mHealth technologies. FDA recognizes that certain mHealth products that fall within the Agency's jurisdiction are intended for uses that present low risk to patient safety and should not be regulated at this time. FDA is choosing to exercise its enforcement discretion with respect to these types of claims. For other mHealth products, it is unclear whether FDA regulation is appropriate due to ambiguity in the language of the statute and associated claim terminology. Manufacturers and FDA staff should use this document in evaluating whether a given mHealth product is regulated and, if regulated, the process for determining what classification applies.

Appendix A: Current Regulatory Classifications and Product Codes for Accessories and Software in mHealth Systems

Classification Reg. (21 CFR)	Description	Device Class	Product Codes
862.1345	Glucose test system	II	CFR, CFW, CGA, CGD, CGE, LFR, MRV, NBW
862.2050	General purpose laboratory equipment labeled or promoted for a specific medical use	I	GLE, JBS, JJP, JQC, JQO, JQQ, JQY, JQZ, JRB, JRC, JRG, JRI, JRJ, JRK, JRL, JRM, JRO, JRQ, JRR, JRS, LCI
862.2100	Calculator/data processing module for clinical use	I	JQP, NVV
864.2240	Cell and tissue culture supplies and equipment	I	KIY, KIZ, KJA, KJB, KJC, KJD, KJE, KJF, KJH, NVG
864.3600	Microscopes and accessories	I	IBJ, IBK, IBL, IBM, KEG, KEH, KEI, KEJ
864.4010	General purpose reagent	I	HZI, IAL, IAM, IAT, IAW, IAY, IBB, IER, IEX, IEZ, IFF, IFH, IFI, IFJ, IFL, IFN, IFO, IFP, IFQ, IFS, IFT, IFY, IFZ, IGB, IGC, IGD, IGE, IGF, IGG,IGK, IGM, IGN, IJZ, JCB, JCC, JCE, KDX, KDY, KEE, KEF, KEL, KEM, KEO, KEP, KEQ, LDT, LDW, LDX, LDY, LDZ, LEA, LEB
868.2377	Apnea monitor	II	NPF
870.1025	Arrhythmia detector and alarm	II	DSI, MHX, MLD, MXD
870.1100	Blood pressure alarm	II	DSJ
870.1110	Blood pressure computer	II	DSK
870.1120	Blood pressure cuff	II	DXQ, NPP, OED
870.1130	Noninvasive blood pressure measurement system	II	DXN

Classification Reg. (21 CFR)	Description	Device Class	Product Codes
870.1875	Stethoscope	I/II	DQD, LDE, OCR
870.2340	Electrocardiograph	II	DPS, MLC, OEY
870.2360	Electrocardiograph electrode	II	DRX, MLN
870.2390	Phonocardiograph	I	DQC
870.2400	Vectorcardiograph	II	DYC
870.2700	Oximeter	II	DQA, MUD, NLF, NMD, OCH
870.2710	Ear oximeter	II	DPZ
870.2810	Paper chart recorder	I	DSF
870.2860	Heart sounds transducer	II	JOO
870.2880	Ultrasonic transducer	II	JOP
870.2910	Radiofrequency physiological signal transmitter and receiver	II	DRG
870.2920	Telephone electrocardiographic transmitter and receiver	II	DXH
876.1300	Ingestible telemetric gastrointestinal capsule imaging system	II	NSI, NEZ, NYZ
876.1725	Gastrointestinal motility monitoring system	II	FES, FFX, KLA

Classification Reg. (21 CFR)	Description	Device Class	Product Codes
876.1735	Electrogastrography system	II	MYE
880.2400	Bed-patient monitor	I	KMI
880.2700	Stand-on patient scale	I	FRI
880.2720	Patient scale	I	FRW
880.2910	Clinical electronic thermometer	II	FLL
880.6300	Implantable radiofrequency transponder system for patient identification and health information	II	NRV
880.6310	Medical device data systems	I	OUG
880.6315	Remote medication management system	II	NZH
882.1400	Electroencephalograph	II	GWQ, OLT, OLU, OLV, OLW ,OLX, OLY, OLZ ,OMA, OMB, OMC, ORT
882.1410	Electroencephalograph electrode/lead tester	I	GYA
882.1420	Electroencephalograph signal spectrum analyzer	I	GWS
882.1430	Electroencephalograph test signal generator	I	GWR
882.1540	Galvanic skin response measurement device	II	GZO
882.1560	Skin potential measurement device	II	HCJ
882.1570	Powered direct-contact temperature measurement device	II	HCS

Classification Reg. (21 CFR)	Description	Device Class	Product Codes
882.1610	Alpha monitor	II	GXS
882.1835	Physiological signal amplifier	II	GWL
882.1845	Physiological signal conditioner	II	GWK
882.1855	Electroencephalogram telemetry system	II	GYE
882.5050	Biofeedback device	II	HCC
884.2050	Obstetric data analyzer	III	HEO
884.2600	Fetal cardiac monitor	II	KXN
884.2620	Fetal electroencephalographic monitor	III	HGO
884.2640	Fetal phonocardiography monitor and accessories	II	HFP
884.2660	Fetal ultrasonic monitor and accessories	II	HEI, HEJ, HEK, HEL, HEP, HEQ, KNG, LXE, MAA
884.2730	Home uterine activity monitor	II	LQK, MOH
884.2740	Perinatal monitoring system and accessories	II	HGM
884.2800	Computerized labor monitoring system	II	NPB
890.1375	Diagnostic electromyography	II	IKN, KZM, OAL
890.3075	Cane	I	IPS, KHY
890.3150	Crutch	I	IPR

Classification Reg. (21 CFR)	Description	Device Class	Product Codes
890.3710	Powered communication system	II	ILQ
890.3725	Powered environmental control system	II	IQA
890.3800	Motorized three-wheeled vehicle	II	INI
890.3825	Mechanical walker	I	ITJ, NXE
890.3850	Mechanical wheelchair	I	IOR, LBE
890.3860	Powered wheelchair	II	ITI
890.3880	Special grade wheelchair	II	IQC
890.3890	Stair-climbing wheelchair	III	IMK
890.3900	Standup wheelchair	II	IPL
890.5050	Daily activity assist device	I	IKW, IKX, ILC, ILD, ILS, ILT, ILW, IQG, NXB, NXQ, OAG, OIZ, OJL
890.5350	Exercise component	I	IOD
890.5360	Measuring exercise equipment	II	ISD
890.5380	Powered exercise equipment	I	BXB, IOL, IRR
890.5575	Powered external limb overload warning device	II	IRN
892.1180	Bone sonometer	II	MUA
892.1540	Nonfetal ultrasonic monitor	II	JAF

Classification Reg. (21 CFR)	Description	Device Class	Product Codes
892.1550	Ultrasonic pulsed Doppler imaging system	II	IYN
892.1560	Ultrasonic pulsed echo imaging system	II	IYO, NQQ, OIJ
892.1570	Diagnostic ultrasonic transducer	II	ITX, MUI, OUJ
892.1720	Mobile x-ray system	II	IZL
892.2010	Medical image storage device	I	LMB, NFF
892.2020	Medical image communications device	I	LMD, NFG
892.2030	Medical image digitizer	II	LMA, NFH
892.2040	Medical image hardcopy device	II	LMC, NFI
892.2050	Picture archiving and communications system	II	LLZ, NFJ, NEW, OEB, OMJ

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Appendix B: Proposed Regulatory Classifications for Accessories and Software in mHealth Systems

Description	Definition	Classification[43]
General purpose health applications labeled or promoted for a specific medical use	General purpose health applications labeled or promoted for a specific medical use are software devices used in an mHealth system to electronically collect, store, transmit, display, and analyze (e.g., trending[44]) health-related data and that are labeled or promoted for a specific medical use (e.g., physical therapy, sleep monitoring, stress management, and weight management) not associated with a specific disease. An example is a software device stored on a smartphone that electronically trends daily exercise and weight information from a variety of sensors and displays the data for use in the treatment of non-morbid obesity.	Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9.
Physical therapy health application	A physical therapy health application is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data for physical therapy purposes associated with a specific medical disease. An example is a software device that collects and displays trends of data from an exercise monitoring system to evaluate improvements in joint function associated with arthritis.	Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9.
Sleep monitoring health application	A sleep monitoring health application is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data for monitoring a sleep-related medical disease or condition. An example is a software device that collects and displays trends of data from an on-body respiratory sensor, ECG monitor, and limb activity sensor for the detection of insomnia.	Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9.
Stress management health application	A stress management health application is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data to diagnose or treat a stress-related medical disease or condition. An example is a software device that collects and trends blood pressure, ECG, and physical activity data to diagnose or treat a stress-related disease or condition (e.g., depression).	Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9.

[43] The classification for each of these generic device types is based on an evaluation of the intended use as defined here. The evaluation of intended use includes consideration of the various factors described in Section IV. An assessment of each mHealth product must be conducted to ensure that the intended use does not fall outside of the definitions of the generic device type established in these classification regulations.

[44] A trend is the analysis and display/report of a specific data element (e.g., blood pressure or weight) over time for a given patient.

Description	Definition	Classification[43]
Weight management health application	A weight management health application is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data to diagnose or treat a weight-related medical disease or condition. An example is a software device that analyzes daily weight and physical activity data to monitor pregnancy-related medical diseases or conditions.	Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9.
Diabetes health application	A diabetes health application is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data generated from one or more devices used in diabetes management (e.g., a blood glucose meter, weight scale, and blood pressure cuff). This does not include data collected for real-time or active patient monitoring.	Class II (special controls).
Cardiac disease health application	A cardiac disease health application is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data generated from one or more devices used in cardiac disease management (e.g., ECG monitor, weight scale, and blood pressure cuff). This does not include data collected from an implantable cardiac device or for real-time or active patient monitoring.	Class II (special controls).
Therapy compliance health application	A therapy compliance health application is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data generated from one or more devices used in therapy compliance (e.g., RF-enabled pill, electronic medication dispensers, electronic pill bottles). This does not include data collected for real-time or active patient monitoring.	Class II (special controls).
Health application for monitoring activity associated with a specific medical disease or condition	A health application for activity monitoring associated with a specific medical disease or condition is a software device used to electronically collect, store, transmit, display, and analyze (e.g., trending) data generated from one or more devices used in the monitoring of an individual's activity associated with a specific medical disease or condition. An example is a software device that analyzes data from home-based sensors that detect falls, physical movement, food consumption, and toileting for physical therapy purposes.	Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9.

Description	Definition	Classification[43]
Device controllers (for Class I exempt devices)	A device controller (for Class I exempt devices) is a hardware or software device used to electronically control the functionality of a Class I device exempt from premarket notification requirements that is part of an mHealth system. An example of a device controller is a software device that electronically triggers a sensor device in an mHealth system to perform a task (e.g., to collect health-related information, or to notify the user to respond to predetermined, health-related questions).	Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9.
Device controllers (for Class II or III devices)	A device controller (for Class II or III devices) is a hardware or software device used to electronically control the functionality of a Class II or III device that is part of an mHealth system. An example of a device controller is a software device that electronically triggers a sensor device in an mHealth system to perform a task (e.g., to collect health-related information, or to notify the user to respond to predetermined, health-related questions).	a) Class II (special controls) if associated with a Class II device. b) Class III (premarket approval) if associated with a Class III device.
General data aggregator and report generator	A general data aggregator and report generator[45] is a hardware or software device intended to produce an electronic report of health-related and/or medical device data generated from one or more sources connected via an mHealth system and that are labeled or promoted for a specific medical use (e.g., physical therapy, sleep monitoring, stress management, and weight management not associated with a specific disease). An example of a data aggregator and report generator is a software device that electronically generates a report of data collected from a weight scale, blood pressure cuff, and a proprietary device that manually prompts the user to respond to pre-determined, health-related questions.	a) Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9. b) Class II (special controls) if the device analyzes the data for any purpose other than reporting the data in an aggregated form.

[45] A data aggregator and report generator analyses and displays/reports multiple data elements (e.g., age, sex, blood pressure, and weight) for a given patient at a specific point in time. Data aggregators and report generators may include trending functions.

Description	Definition	Classification[43]
Diabetes data aggregator and report generator	A diabetes data aggregator and report generator is a hardware or software device intended to produce an electronic report of data generated from one or more devices used in diabetes management (e.g., a blood glucose meter, weight scale, and blood pressure cuff). This does not include data collected for real-time or active patient monitoring.	a) Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9. b) Class II (special controls) if the device analyzes the data for any purpose other than reporting the data in an aggregated form.
Cardiac disease data aggregator and report generator	A cardiac disease data aggregator and report generator is a hardware or software device intended to produce an electronic report of data generated from one or more devices used in cardiac disease management (e.g., ECG monitor, weight scale, and blood pressure cuff). This does not include data collected from an implantable cardiac device or for real-time or active patient monitoring.	a) Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9. b) Class II (special controls) if the device analyzes the data for any purpose other than reporting the data in an aggregated form.
Therapy compliance data aggregator and report generator	A therapy compliance data aggregator and report generator is a hardware or software device intended to produce an electronic report of data generated from one or more devices used in therapy compliance (e.g., RF-enabled pill, electronic medication dispensers, electronic pill bottles). This does not include data collected for real-time or active patient monitoring.	a) Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9. b) Class II (special controls) if the device analyzes the data for any purpose other than reporting the data in an aggregated form.

Description	Definition	Classification[43]
A data aggregator and report generator for activity monitoring associated with a specific medical disease or condition	A data aggregator and report generator for activity monitoring associated with a specific medical disease or condition is a hardware or software device intended to produce an electronic report of data generated one or more devices used in the monitoring of an individual's activity associated with a specific medical disease or condition. An example is a software device that aggregates data from home-based sensors that detect falls, physical movement, food consumption, and toileting for physical therapy purposes.	a) Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 8xx.9. b) Class II (special controls) if the device analyzes the data for any purpose other than reporting the data in an aggregated form.

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Appendix C: Additional Considerations Regarding the Accessory Rule in an mHealth System

Given the diversity of mHealth products, a number of additional aspects of the accessory rule are worth exploring to understand how the rule applies in this context.

Human intervention may affect the application of the accessory analysis and the resulting classification. Human intervention may impact whether a device is intended to be attached to or used in conjunction with another finished device and, thus, whether the device can even be regulated as an accessory.

Generally, a device may be regulated as an accessory if it operates in conjunction with a finished device by, for example, accepting data from a user and modifying it for input into the finished device, taking data from the finished device and modifying it for presentation to a user, or otherwise enhancing the performance of the separately distributed finished device. As such, introducing human intervention between the medical device and the putative accessory may interrupt the connection between the two products, meaning that the product at issue does not qualify as an accessory. Manual data entry can be a form of human intervention.

A weight scale and a software app that communicates manually entered data to a personal health record is a simple example where human intervention interrupts the connection between the finished device and the would-be accessory. Although the weight scale is a medical device and the software app operates in conjunction with and enhances the performance of the weight scale, the software app is not an accessory in this example because the manually entered data constitutes human intervention that breaks the connection between the two products.

Human intervention that renders a product a non-accessory may have important implications for the regulatory status of the would-be accessory. Remember, if you are considering whether a device is an accessory means you have already concluded that the device does not have an existing classification. Subject to limited exceptions, if the device at issue is not adequately described by a current device classification, the device is automatically designated a Class III device and is subject to premarket approval (PMA). A Class III device designation may be changed to Class I or II through the *de novo* review process, or any other form of reclassification.

The following are examples of relationships that could potentially form a parent device-accessory link.

1. Class III connected to Class I or II

    a) Device-to-accessory: Implantable cardioverter defibrillator (device) connected to a body area network sensor for blood pressure (accessory). The link is created here because the blood pressure sensor is a medical device but falls outside of an existing classification. The sensor would be regulated as an accessory to the defibrillator (i.e., Class III).

    b) Device-to-non-accessory: Pacemaker (device) connected to a smartphone (non-accessory) for communication of medical device data. The link is not created here

because the existing MDDS classification would apply to the smartphone, which would be regulated at that classification (i.e., Class I).[46]

2. Class II connected to Class I

a) Device-to-accessory: Blood pressure cuff (device) connected to software app for reporting of blood pressure data (accessory). The link is created here because the software app analyzes the blood pressure cuff data and generates a report of that data. The software app is a medical device and fails to fall within an existing classification. The app would, therefore, be regulated at as an accessory to the blood pressure cuff (i.e., Class II).

b) Device-to-non-accessory: Pulse oximeter (device) connected to a weight scale (non-accessory) for storage and display of the pulse oximeter and weight measurement data. The link is not created here because the weight scale would fall into an existing classification (i.e., Class I).

3. Device connected to non-device

a) Pulse oximeter (device) connected to a wrist watch (non-accessory). The link is not created because the wrist watch is not a device and is, therefore, not regulated.

It is important to understand what happens to "accessories to accessories". Consider the following. In mHealth, there may be a configuration where a device transmits data to Product A; Product A transmits information to a Database (stored on Product B); and Product B transmits data to Product C. The mere existence of the original parent device and its transmission of data to Product A does not necessarily mean that Product A is a medical device. The status of Product A depends upon whether it is a medical device in its own right. If it is, FDA would analyze whether the device fits within an existing classification regulation. If no classification regulation exists (and the device manufacturer has not requested a reclassification), then FDA would analyze whether it is an accessory to the original parent device. For the same reason, the fact that Product A is a medical device does not necessarily render the Database or Product B a device. A break in the chain (i.e., if one of the Products is not a medical device or an accessory to a medical device) does not necessarily render the remainder of the products in the chain unregulated. Each product in the chain should be evaluated independently.

The bi-directional flow of data (i.e., both from the patient/device to the health care professional and from the health care professional to the patient/device) may impact classification. This particular factor does not impact the general framework for deciding whether a particular item is a medical device or an accessory. However, this feature/functionality may impact whether the particular item qualifies (i.e., based on the answers to the framework questions) as a medical device or operates as an accessory.

Consider a device• non-device• device connection, such as a pacemaker (Class III)• computer/smartphone (unregulated)• weight scale (Class I) connection. The classification of

[46] This example assumes that the smartphone falls into the Class I MDDS device. The purpose of this example is not to suggest that smartphones are Class I MDDS devices but to say that a Class I MDDS smartphone would not be an accessory to the Class III pacemaker. In fact, not all smartphones will be regulated or will fall into the MDDS classification. For example, merely promoting a smartphone as a communication tool that is capable of running a software device app does not trigger FDA regulation. On the other hand, if the manufacturer modifies the phone or tailors the phone for the software device app, the smartphone would become a medical device and the classification determination would depend on the intended use of the smartphone based on those modifications.

the Class III device is not necessarily imputed to all products in the chain, including the non-devices. The same analysis applies, meaning that the first step for analyzing the status of the non-device is to consider whether it is a device at all. If it is not, it is not an accessory. Adding a software app on the computer/smartphone does not affect the regulatory status of the computer/smartphone as a hardware platform. The software app, however, may be regulated as an independent medical device or as an accessory based on its intended use. Even if instead of going through a chain, the products were connected through a web, with the sensor transmitting to multiple products, the framework still applies.

Appendix D: Claims of Compatibility and Associated Regulatory Obligations

Claims of compatibility in an mHealth system require the manufacturer of the product making the claims to substantiate those claims through validation testing and quality system controls. Consider the following scenarios:

1. The PawPrick Brand software device manufacturer makes a claim that its product will work with all major blood glucose meters, all meters that meet a particular standard, or a PrickAxe Brand blood glucose meter and only a PrickAxe Brand meter. The PawPrick manufacturer must substantiate the claim through validation testing. The blood glucose meter manufacturers have no obligations to substantiate the claim made by the PawPrick manufacturer. The PawPrick manufacturer carries the burden of maintaining adequate design controls to respond to changes that occur in the blood glucose meters.

2. The PrickAxe Brand blood glucose meter manufacturer makes a claim that its device will work with a PawPrick Brand software device and only a PawPrick Brand software device. The PrickAxe manufacturer must substantiate the claim through validation testing. The PawPrick manufacturer has no obligations to substantiate the claim made by the PrickAxe manufacturer. The PrickAxe manufacturer carries the burden of maintaining adequate design controls to respond to changes that occur in the PawPrick software device.

3. Both occur at the same time, such that there is a uniquely one-to-one relationship between the PawPrick software device and the PrickAxe blood glucose meter. The unique "one-to-one" relationship between the PawPrick device and the PrickAxe device requires that the manufacturers work together to ensure that the claims are substantiated and that any changes made to either device are validated. Both manufacturers must ensure that adequate design controls are in place to account for changes that occur in the future. If the manufacturers cease cooperating together such that the changes to either of the devices are not validated, they can no longer make claims of one-to-one compatibility. Although not required by regulation, having an agreement in place to exchange information regarding product complaints and safety events is generally considered good practice.

Claim substantiation does not change the device classification of either product (i.e., the lower-class device does not get up-regulated). In none of the examples above does the classification of the individual devices change. Only the validation burden changes as a result of the claims of compatibility.