THE HENRY J. KAISER FAMILY FOUNDATION

THE KAISER COMMISSION ON
Medicaid and the Uninsured

SICKER AND POORER:

THE CONSEQUENCES OF BEING UNINSURED

MAY 2002

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THE COST OF NOT COVERING THE UNINSURED PROJECT

The Kaiser Family Foundation initiated the Cost of Not Covering the Uninsured project to explore what is known and what should be known about the costs society incurs by leaving nearly 40 million individuals uninsured. Under this initiative, we convened an expert advisory group that worked with staff of the Kaiser Commission on Medicaid and the Uninsured and other researchers to develop new information and analyses to further our understanding of and raise awareness about this critical issue.

The first stage of this initiative has been to review the relevant literature and synthesize what is known about the consequences of being uninsured. Work is underway to estimate the amount of money already being spent on care provided to the uninsured; assess the financial toll on the uninsured when they seek care; explore the economic benefits of a fully insured population; and evaluate the implications of insurance expansions to the near-elderly.

Advisory Group

SICKER AND POORER: THE CONSEQUENCES OF BEING UNINSURED

A REVIEW OF THE RESEARCH ON THE RELATIONSHIP BETWEEN HEALTH INSURANCE, HEALTH, WORK, INCOME AND EDUCATION

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May 2002

for

"The Cost of Not Covering the Uninsured Project"

Prepared for the Kaiser Commission on Medicaid and the Uninsured.

I would like to thank John Holahan, James Reschovsky, Sharon Long, Stephen Zuckerman, Genevieve Kenney, Len Nichols, Linda Blumberg, the members of the Advisory Committee for "The Cost of Not Covering the Uninsured Project" (Robert Reischauer, Sheila Burke, Arnold Epstein, Judith Feder, Dorothy Rice, Earl Steinberg, James Tallon, Marta Tienda and Uwe Reinhardt), and the Kaiser Family Foundation staff (Diane Rowland, Barbara Lyons, Catherine Hoffman, David Rousseau, Larry Levitt, and Rachel Garfield) for their very helpful comments on earlier drafts of this report, and Marc Rockmore and James Celestin for their research assistance with all aspects of this work.

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CONTENTS

ABSTRACT

Sicker and Poorer: The Consequences of Being Uninsured

A Review of the Research on the Relationship between Health Insurance, Health, Work, Income and Education

Overall, health services research published in the past 25 years makes a compelling case that having health insurance or using more medical care improve health. A mid-range estimate of the effect of extending health insurance coverage to all would be a 10-15% reduction in mortality rates of the uninsured. A reduction of this magnitude is comparable to the reduction in overall mortality over the last 40 years. The literature also suggests that improved health would increase both educational attainment and annual earnings from work.

CHAPTER 1 - INTRODUCTION

Much of the current debate over providing health insurance for the uninsured revolves around questions of cost and strategy (Glied, 2001; Kahn and Pollack, 2001; Feder et al., 2001; Pauly and Herring, 2001). How much will it cost? Who will pay? Should it be public or private insurance? Should employers or workers be subsidized? Should subsidies be provided through tax credits or vouchers?

While these are obviously important policy questions, the emphasis on costs and policy mechanisms tends to push into the background an even more fundamental question. Does having health insurance improve your health? Although this question is deceptively simple, there is no definitive research that unambiguously answers this question, one way or the other.

Why is this question important? If being uninsured leads to poorer health, inefficient use of medical care resources, fewer hours worked and lower earnings, and lower educational attainment, then a large uninsured population creates costs in the form of foregone opportunities, which do not appear as explicit government payments or budgetary line items. Reducing opportunity costs, by extending health insurance coverage to all Americans, could create significant offsets to the direct costs of expanded insurance coverage. If complete insurance coverage leads to better health, to greater investment in human capital, and to fuller and more productive work, then the nation would be both healthier and wealthier. Conversely, if having health insurance does not improve health, then the case for expanding insurance coverage through greater public spending would be much weaker.

An ideal study designed to answer this question would randomly assign a representative sample of people to insured (treatment) and uninsured (control) groups.[1] People in the treatment group would presumably use more medical care than people in the control group because having insurance lowers its cost relative to what people in the uninsured group would have to pay. The extra services used by the insured might be a mix of more preventive care, more screening and diagnostic care designed to detect disease at an early, more treatable phase, and more aggressive treatment of illness when it occurs. Some people without insurance would find such treatments unaffordable and choose to forego care or not be able to find a medical provider willing to treat them at reduced or no cost. If these are the effects of having insurance, then we might very well expect the insured group to have better health after some period of time.

But suppose instead that the extra care received by the insured group was primarily medical services that were unneeded and provided little clinical benefit. In other words, perhaps the insured seek and receive a lot of care simply because the insurance company pays most of the bill and it doesn't cost them very much. Suppose also that people without insurance are generally able to get care when they really need it. In this case, we might conclude that having insurance does not lead to better health. Rather, the extra medical care received by the insured is really unnecessary, or at least does not provide any added health benefit.

There is only one study, the RAND Health Insurance Experiment (Newhouse et al. 1993), that randomly assigned people to different types of health insurance coverage. That study, which is nearly twenty-five years old now, was designed primarily to test

[1] The elderly might be excluded since they already have near-universal insurance coverage through Medicare.

whether differences in cost-sharing influenced how much medical care people received. It demonstrated quite clearly that lower cost-sharing increased the amount of medical care people used. It also concluded that "…for the average person there were no substantial benefits from free care." (Newhouse et al. 1993, p. 201)

However, the problem of uninsurance in America today is not a problem of the average American - it is primarily a problem of low-income people (Hoffman and Schlobohm 2000) for whom the cost of insurance is often an insurmountable barrier to obtaining coverage. Although the RAND Health Insurance Experiment included some low-income families, it was not primarily designed to address the question of the effect of being uninsured on health, but rather the effects of differences in cost-sharing on the use of services by a predominantly insured population.

What does the research tell us about the impact of insurance coverage on health? Many studies have addressed the relationship between health insurance and health, either directly or as a by-product of another research question in which insurance status is among the control variables used in the analysis. However, all of these studies suffer to varying degrees from methodological flaws.

In the absence of a "smoking gun," one must draw conclusions based on the weight of the available evidence. Levy and Meltzer (2001) distinguish between "…observational, quasi-experimental [natural experiments], and experimental" studies. Only the RAND Health Insurance Experiment falls into the last, most methodologically rigorous category. They argue that observational studies should be completely ignored because they are hopelessly confounded by the methodological problems of (1) identifying the direction of causation between health insurance and health, and (2)

controlling for unobserved factors that might simultaneously determine both health insurance coverage and health. However, observational studies make up the vast majority of the available research. Ignoring them literally leaves only a handful of natural experiments from which to draw inferences about the impact of health insurance on health.

This report takes a broad rather than narrow approach to considering research that might help us answer, or at least form an opinion about whether health insurance improves health. Rather than ignoring observational studies, they are included with annotations as to their methodological strengths and weaknesses. Some observational studies use statistical methods designed to correct for their potential problems. Others involve research designs that potentially mitigate underlying problems of the direction of causation or the effects of unobserved factors. While circumstantial evidence is not as clear-cut as experimental evidence, it is not inherently wrong per se. Judgments about whether health insurance improves health should be based on the weight of all the evidence, discounting findings for methodological reasons when appropriate, but also noting similarities across studies of different populations in different circumstances.

This report reviews research on the relationships among health insurance, timely use of medical care, health, education, work, and earnings in order to assess the hypothesis that lack of insurance imposes significant costs on American society. A full and fair debate over whether to extend insurance coverage to all Americans requires information on the benefits, if any, as well as the costs of providing health insurance to the uninsured.

The review is organized around a conceptual framework that traces how having health insurance might affect health and subsequent educational attainment and work outcomes. As noted above, it is often difficult to identify the direction of causation between health, on the one hand, and health insurance and medical care use on the other. Failure to account for this and other methodological problems may confound empirical studies of the effects of health insurance and medical care use. Nevertheless, this review includes a substantial body of observational studies because they vary in the degree to which they use statistical methods or incorporate a research design that might mitigate potential biases, and addresses the following questions. To what extent are the results of the observational studies consistent with the implications of the quasi-experimental research? How consistent are the results of studies of different populations, with different diseases, in different times and places? To what extent do the studies that fail to find positive health effects of health insurance or medical care use employ methods or research designs that correct for potential underlying bias?

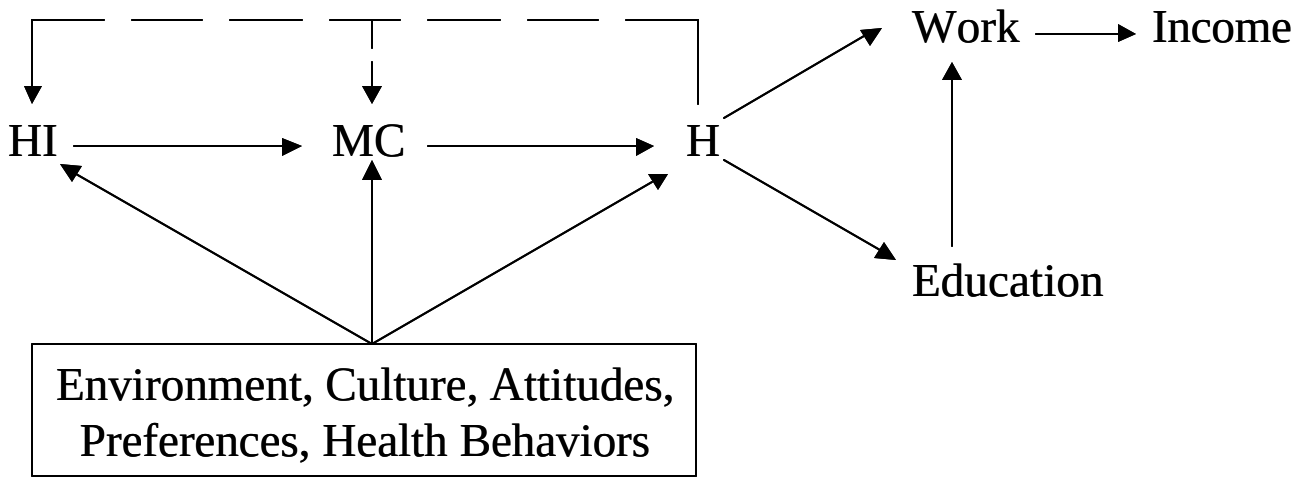
CHAPTER 2 - CONCEPTUAL FRAMEWORK

The conceptual framework used to organize this review represents a portion of a complete model of the determinants of health. As illustrated in Figure 1, the framework hypothesizes that health insurance influences the quantity, quality, and efficiency of medical care used; medical care use influences health; and health affects educational attainment, work effort, productivity, and income through these pathways. This review seeks to evaluate whether the evidence supports the conclusions that these effects are in fact positive, which implies that

- lack of insurance makes it harder for people to obtain needed acute medical care and preventive medical services on a timely and efficient basis;
- reduced medical care use (in terms of either quantity, quality, or timeliness) lowers health status;
- poor health reduces the ability to work and, for younger people, their ability to invest in their own human capital through more schooling and greater academic achievement; and
- over time, reduced ability to work and lower investment in human capital reduce the uninsureds' contributions to our national output and to their own incomes.

Figure 1

Conceptual Framework of the Relationships Among Health Insurance, Medical Care Use, Health, Education, and Income



HI - Health Insurance MC - Medical Care H - Health

As simple as this framework appears, the underlying reality is much more complex and, as a result, empirical verification of these relationships has not been straightforward. One major problem confounding empirical attempts to measure the relationship between health insurance or medical care use and health is that health itself influences both insurance coverage and medical care use, as shown by the dashed arrows in Figure 1. A second major problem is represented by the box representing, environment, culture, attitudes, preferences and health behaviors. These factors, which are often difficult to measure or are completely unobserved in empirical studies, can influence each of the elements along the hypothesized causal chain from health insurance to health, income and education. Failure to control for their effects, either by direct measurement or by research design, can bias the results of empirical studies. Finally, although not indicated in the figure, income and education most likely also loop back as factors influencing both health and health insurance coverage, further complicating statistical analyses of the effects of health insurance on health, income and educational attainment.

For example, suppose that, compared to people in good health, people in poor health have a higher demand or perceived need for health insurance, greater medical care use and worse health outcomes, because of their underlying poor health. Under these conditions, a simple correlation between health insurance and health might show that the insured have poorer health than the uninsured. It is also possible that people who place a high value on health will be both more likely to purchase insurance and to engage in healthy behaviors. This type of "unobserved heterogeneity" across people could also lead to biased estimates of the effect of health insurance on health.

As another example, some people qualify for public insurance programs by incurring substantial medical expenses or suffering from major health declines. Thus, comparing these people to those who may look "the same" in terms of observable characteristics can result in the conclusion that providing public insurance coverage reduces health (Ross and Mirowski, 2000). Furthermore, because our insurance system for the non-aged is so heavily tied to work, lower labor force participation, lower human capital, and lower earnings all reinforce the uninsureds' difficulties in obtaining insurance coverage through existing mechanisms.

Empirical studies can also be confounded by difficulties in measuring health, health insurance, and medical care use. All three are multi-dimensional constructs with important temporal components. Surveys typically measure health and health insurance status at a point in time, but medical care use over a fixed time period, such as a year or the preceding three months. Similarly, health insurance can have a broad or narrow benefits package, can offer generous or stingy payment rates to providers, and can have small or large patient cost-sharing obligations. All of these factors influence the quantity and timing of medical care use, and the subsequent relationship between insurance status and health outcome.

Finally, it can be difficult to infer causation from empirical studies because of the dynamic nature of the inter-relationships among health insurance, medical care use, and health. For example, a person insured through their job may incur a random illness or accident that reduces health, leads to job loss, and ultimately to the loss of insurance. When based on interviews at a point in time, the data might suggest that insurance loss led to reduced health, when in fact, in this particular example, poor health led to

insurance loss. Moreover, the positive effects on health of increased medical care use flowing from continuous and reliable insurance coverage may take several years to manifest themselves. Thus, expansions of public insurance programs may have a much larger impact on spending than on measurable health improvement in the short term, especially if public insurance coverage is intermittent, fluctuating as people's incomes move them just above or below eligibility cutoffs.

CHAPTER 3 - REVIEW STRATEGY AND STRUCTURE

Studies were initially selected by searching other literature reviews and bibliographies (American College of Physicians, 2000; Institute of Medicine, 2001; Howell, 2001; Currie and Madrian, 2000: Office of Technology Assessment, 1992; Hadley, 1982). We also conducted a series of key word searches of the National Library of Medicine's Medline database and of the Journal of Economic Literature's EconLit database. Various combinations of key words were used in the searches: health status and health insurance (or payer source), health outcomes and health insurance, health insurance and mortality, and health insurance and specific diseases (cancer, diabetes, heart disease, etc.). The time period for the keyword searches was limited to 1991 through 2001.

The individual searches identified from as few as 9 to as many as 1,826 citations, depending on the specificity of the key words. Over 9,000 citations (many of which appeared in more than one search) were screened. We also reviewed the bibliographies of selected studies to identify other studies either missed by the keyword search or from earlier years. Both published and unpublished work was considered. The review by Currie and Madrian (2000) was the primary source for identifying studies of the effects of health on labor supply and income, supplemented by other studies that are either more recent or were identified through the key word searches.

Screening the citations produced by the key-word searches, past literature reviews, and individual studies' bibliographies identified 285 distinct, potentially relevant articles for more detailed evaluation to determine if they met minimal criteria for inclusion: explicit identification of an uninsured or self-pay population, sample size of at

least 100 cases, and multivariate statistical analysis of the relationships among health insurance, medical care use, and health. (Some studies that do not meet all of these criteria are included in the review, with their methodological weaknesses noted, if they present unique information not addressed by any other studies.) Although some studies may have been omitted inadvertently, we believe that the great majority of relevant research was identified and considered.

The studies of health outcomes were then organized into three major groups: (1) specific diseases or conditions, (2) general health outcomes for adults, and (3) birth, maternal, and child health outcomes. In each of these sections, we consider studies that examine directly the relationship between health insurance and health, as well as studies that analyze the relationship between health insurance and medical care use, and between medical care use and health.

Since the positive effect of having health insurance on medical care use has been widely demonstrated and generally accepted (American College of Physicians, 2000; Newhouse et al. 1993; Marquis and Long 1994), the methodological assessment of the literature is limited to studies of health outcomes. As noted above, the primary threats to the validity of observational studies are potential reverse causality between health and either health insurance coverage and/or medical care use, and unobserved heterogeneity, i.e., the effects of unobserved differences between insured and uninsured people that may simultaneously affect whether they have insurance and their health outcome. However, these effects can sometimes be mitigated by the use of appropriate statistical methods, primarily instrumental variable estimation (Newhouse and McClellan 2001), by the availability of extensive and detailed data on people's health and socio-demographic

characteristics, and/or by other elements of research design, especially the analysis of "exogenous" health shocks, i.e., the response to a change in health for a condition or event whose occurrence can be assumed to be reasonably independent of whether a person has insurance coverage.

Both observational studies and natural experiments may be subject to other threats to validity, which are also noted. For example, as sample size decreases, the ability to detect significant differences in health between insurance groups declines. An analysis based on data from a single or small number of institutions or geographic areas may be affected by unique characteristics of that institution or geographic area and, therefore, its results may have limited applicability to other populations. Incomplete or inadequate measurement of other control variables may bias or distort the effects of insurance coverage. Including the elderly, who have near universal coverage through Medicare, or nonelderly Medicare beneficiaries, who qualify for Medicare for health reasons (end-stage renal disease or long-term disability) may distort the comparison of the insured and uninsured non-elderly in an analysis. Finally, there may be problems in the measurement and coordination of time periods of health status, insurance coverage, and/or medical care use.

A separate section considers the special case of Medicaid coverage and health outcomes. Many of the studies reviewed find either that people with Medicaid coverage have poorer health outcomes than the privately insured (and sometimes than the uninsured), or that the substantial expansions of Medicaid coverage to low-income women and children had no significant impact on health. These results are sufficiently pervasive in the literature, that they warrant a separate examination.

The review begins with the studies of people with specific diseases, looking at the effects of both insurance coverage and service use on health outcomes. These studies are important because they help to identify the specific links of the causal chain between insurance coverage, service use, and outcome. In addition, limiting the population to people with a specific disease may be one way of reducing possible bias from unobservable differences between insured and uninsured people, since both populations have one key health factor in common, i.e., the presence of a specific disease.

The next sections of the review focus on general (as opposed to disease-specific) health outcomes, first for adults and then for newborns, mothers and children, distinguishing between studies of health insurance and health outcomes and studies of medical care use and health outcomes. A key question is whether observational studies of health insurance and general health produce results consistent with studies of medical care use and health, since the bias from unobservable factors is not necessarily in the same direction in the two types of studies. For example, good underlying health may lead one to observe a positive relationship between health insurance and health if healthy people are more likely to be covered by insurance. However, healthy people should also be less likely to use greater amounts of medical care, which might lead to the conclusion that using less medical care produces better health. This would appear to be inconsistent with the observation that having health insurance increases medical care use. Thus, the extent of agreement between the disease-specific and general health outcome studies, and between studies of the effect of health insurance or medical care use on health, will help gauge the amount of confidence one can place on the observational literature.

We then move to the question of the relationship between insurance coverage and the efficiency of medical care resource consumption. Does insurance coverage reduce the rate of hospitalization for preventable or ambulatory-care-sensitive health conditions, and the use of emergency rooms for non-emergency care?

Finally, is there evidence that poor health reduces labor supply and productivity (wage rates), or school attendance and educational attainment? For the former, we focus primarily on studies of annual earnings, which incorporate the effects of health on both labor supply (hours or weeks worked, labor force participation) and productivity or wage rate. For the latter, we recognize that children's health depends both on their parents' health and their own prior and current insurance status.

CHAPTER 4 - INSURANCE, MEDICAL CARE USE, AND OUTCOMES FOR SPECIFIC DISEASES AND CONDITIONS

The first step in assessing whether having health insurance has positive health benefits is to review studies of service use and/or outcomes for specific diseases. If this research shows that uninsured people use fewer diagnostic services, are more severely ill when diagnosed, receive fewer therapeutic services, and have poorer outcomes for specific conditions, then one can infer with much greater confidence that the same mechanisms (less preventive care, late diagnosis and greater severity, and less therapeutic care) explain differences between the insured and uninsured in overall mortality rates or general health status. (See Bunker, Frazier, and Mosteller (1994) for an assessment of the clinical links between these types of services and health benefits.) Moreover, limiting the population to people with a specific condition or disease may be one way of lessening potential bias from differences in unobserved characteristics of insured and uninsured people.

A. Cancer Screening and Detection

Several studies have examined the relationship between insurance coverage and cancer screening and detection. Ayanian et al. (2000) analyzed two large national surveys of nonelderly adults conducted in 1997 and 1998. Even after controlling for differences in detailed underlying health and personal characteristics, the uninsured were significantly less likely than the insured to receive cancer screening services, such as mammography and Pap smears. Breen et al. (2001) also found significantly lower odds of recent cancer screening among the uninsured in the 1998 National Health Interview

Survey, ranging from 0.63 for colorectal screening for females, 0.50 for Pap smear, 0.37-0.33 for mammogram, and colorectal screening and digital rectal exam for men.[2] Although not based on multivariate analysis, the Center on an Aging Society (2002) reported similar differences in mammography and prostate exams from the 1996 Medical Expenditure Panel Survey.

Hsia et al. (2000), who examined data from over 55,000 women who responded to the Women's Health Initiative surveys between 1994 and 1997, found that among nonelderly women lack of insurance significantly reduced the odds of having had a mammogram in the last 2 years, a Pap smear in the last 3 years, or a stool guaiac or a flexible sigmoidoscopy in the last 5 years compared to insured women. Potosky, Breen, and Graubard (1998) analyzed data from over 4,000 adults between the ages of 40 and 64 who were surveyed by the Cancer Control supplement of the 1992 NHIS. Controlling for various socio-demographic factors, the uninsured were significantly less likely than the insured to have received five of six cancer screening tests (mammogram, clinical breast exam, pap smear, digital rectal exam, fecal occult blood testing, and proctosigmoidoscopy). Faulkner and Schauffler (1997) analyzed the relationship between degree of health insurance coverage for specific services and the use of Pap smear, clinical breast examination, and mammography among 24,000 nonelderly adult women who responded to the 1991 Behavioral Risk Factor Surveillance System. They found that compared to women with no coverage for these services, those with coverage for most or all services were from 1.3 to 1.7 times more likely to have received treatment.

[2] The odds ratio represents the relative odds of an event occurring in two populations. Thus an odds ratio of 0.50 for having a Pap smear means that the odds, defined as $p_i/(1-p_i)$, of an uninsured women having Pap over the specified time period is half as large as for an insured women. In this example, the odds ratio of

Hayward et al. (1988) also found in their analysis of a 1986 national telephone survey that lack of insurance significantly reduced the odds of women being screened for cervical or breast cancer. Finally, three other studies have reported significantly lower cancer screening rates for uninsured people, although these studies were limited to either a single state (Arizona (Kirkman-Liff and Kronenfeld 1992); Utah (Merrill 2001), or to a single site (Johnson and Murata 1988)).

Two studies reported no differences in cancer screening. Valdez et al (2001) analyzed a small sample of 583 Latina women who were recruited through three community health centers, two HMO clinics, and a breast cancer outreach program. Eisen et al. (2001) failed to a find a significant insurance effect on having had a prostate screening or digital rectal exam within the last five years in a sample of 2,652 military veterans drawn from the Vietnam Era Twins registry database.

B. Cancer Outcomes

Several studies have examined differences in disease stage at diagnosis, treatment received, and survival from various cancers. In general, being diagnosed with late stage disease (stages III and IV), which may be related in part to a low frequency of cancer screening, has a highly significant and negative effect on survival. Roetzheim et al. (1999) examined stage at diagnosis for 29,237 new cancer cases in Florida in 1994. Controlling for several demographic characteristics and income in logistic regression, they found that the uninsured were significantly more likely than the commercially insured to be diagnosed at a late stage: odds ratio (OR) = 2.59 for melanoma, OR = 1.67

0.5 can be interpreted to mean that 25% (p_i) of uninsured women had a Pap smear, compared to 40% (p_j) of insured women.

for colorectal cancer, OR = 1.43 for breast cancer, and OR = 1.47 for prostate cancer. Using the same Florida data, Ferrante et al. (2000) found that uninsured women diagnosed with cervical cancer were 60 percent more likely to be diagnosed with late-stage disease. From cancer registry data for 4,675 nonelderly women diagnosed with breast cancer between 1985 and 1987 in New Jersey, Ayanian et al. (1993) found that 20.7% of uninsured women were diagnosed with late stage disease, compared to 12.1% of privately insured women (implied OR = 1.89). Lee-Feldstein et al. (2000) analyzed data for 1,788 non-elderly women in northern California diagnosed with breast cancer between 1987 and 1993. They found that uninsured women and publicly insured women were twice as likely to be diagnosed at a late stage.[3] Although not specific to cancer outcomes, Hadley, Steinberg, and Feder (1991), based on analysis of almost 600,000 hospital discharges in 1987, found that hospitalized uninsured people were less likely to receive colonoscopies and endoscopies than the privately insured, but when they did receive them, they were more likely to have abnormal pathology reports.

Several of these studies have also examined cancer survival. Ayanian et al. (1993) found that controlling for disease stage, uninsured women had a two-thirds lower survival probability up to five years post-diagnosis. Lee-Feldstein et al. (2000) found that uninsured and publicly insured breast cancer patients were almost 1.5 times more likely to have died by the end of the observation period compared to women covered by private fee-for-service insurance. A third study of breast cancer survival among cases diagnosed in Florida in 1994 also found higher mortality for uninsured women vs. women with private fee-for-service coverage (adjusted relative risk = 1.31) through the

[3] This study combined uninsured and publicly insured women because preliminary analysis indicated that they had similar results. The studies by Ayanian et al. (1993) and Roetzheim et al. (1999) also found that

end of 1997 (Roetzheim, Gonzales, Ferrante et al. 2000). When stage at diagnosis was also controlled for, the higher risk associated with uninsurance disappeared, suggesting that the primary mechanism underlying the higher mortality rate was the greater likelihood of being diagnosed at a late stage. In a related study, Roetzheim, Pal, Gonzales et al. (2000) analyzed data from 9,551 incident cases of colorectal cancer in Florida in 1994. Controlling for socio-demographic factors the uninsured were just over half as likely to have received definitive surgery for colorectal cancer, compared to the privately insured, and were 1.4 times more likely to have died by 1997. Finally, one study (Penson et al. 2001) measured health-related quality-of-life over three years in a sample of 860 men diagnosed with prostate cancer in 1995. It found that lack of insurance was significantly related to lower quality-of-life ratings over time, although it was unrelated to quality of life at baseline.

One study (Greenberg et al. 1988) found no insurance-related difference in survival for 1,808 people diagnosed with non-small-cell lung cancer in New Hampshire and Vermont between 1973-1976, although privately insured patients were more likely to have received aggressive therapy. This study suggests that the insured are more likely to receive treatment even when the odds of recovery are low. However, the studies by Roetzheim, Pal, Gonzales et al. (2000) of colorectal cancer treatment and outcome in Florida and by Ayanian et al. (1993) of breast cancer outcomes in New Jersey suggest that the uninsured were treated less aggressively even when the cancer is in a site that is more amenable to treatment.

Hadley (1982) estimated a relationship between an instrumental variable estimate of medical care use per capita and cancer mortality rates among eight race-gender-age

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people covered by public insurance were diagnosed at a later stage than privately insured cases.

(45-64 and 65+) specific cohorts across U.S. county groups in 1970. The association was negative and statistically significant for only one cohort, white males ages 45 to 64. He found a positive and significant association for two cohorts, and no association for the remaining five cohorts. These results may reflect medical care's generally poor efficacy in early diagnosis and treatment of cancers at that time. Table 1 summarizes the studies of cancer outcomes.

C. Diagnosis and Treatment of Cardiovascular Disease

Several studies have examined service use by people with hypertension or high cholesterol levels, which are risk factors for cardiovascular disease. Families USA (2001) and Huttin, Moeller and Stafford (2000) both used data from the 1996 MEPS. The former found that the uninsured were significantly less likely than the insured to have been screened or checked within the last year (58.1% of uninsured compared to 75.2% of insured with hypertension and 50% of uninsured compared to 65% of insured with high blood pressure). The latter study found that the uninsured were 59% less likely than the privately insured to have received anti-hypertensive drug therapy. Sudano and Baker (2001) analyzed the use of anti-hypertensive medication by race/ethnicity in a sample of 3,734 people between the ages of 51 and 61 who participated in the national Health and Retirement Survey. They found that the uninsured were less likely to report taking anti-hypertensive medication, especially among Hispanics and African-Americans. In multivariate analysis pooling data on Whites, Hispanics and African-Americans, the uninsured were significantly less likely to report taking anti-hypertensive drugs (corrected OR = 0.90). Finally, Moy, Bartman, and Weir (1995) investigated a sample of 6,158 adults who reported having hypertension on the 1987 National Medical

Expenditure Survey. They found that the uninsured were about 50% more likely than the privately insured to have not had a blood pressure check in the last year, to have had fewer than two doctor visits in the last year, and to not be taking any anti-hypertensive medications.

More generally, two analyses of cardiovascular screening and risk-reduction services in the general population using data from the 1997-1999 Behavioral Risk Factor Surveillance System surveys reported significantly lower use by the uninsured (Ayanian et al. 2000; Brown et al. 2001). Faulkner and Schauffler (1997), who analyzed the use of blood pressure and cholesterol screening among almost 30,000 men from the 1991 Behavioral Risk Factor Surveillance System, found that compared to men without insurance coverage for these services, those who had coverage for some or all preventive services were from 1.3 to 2.8 times more likely to have been screened. Ford et al. (1998) studied 1,724 women between the ages of 50 and 64 who participated in the third NHANES (1988-1994). Compared to insured women, uninsured women had worse cardiovascular risk profiles, but were significantly less likely to have had their blood pressure checked in the previous 6 months and to have had their cholesterol level checked, and one-third as likely to have used estrogen replacement therapy.

Several studies have found that uninsured people admitted to the hospital with a heart attack are less likely to receive major therapeutic procedures. Young and Cohen (1991) studied nearly 5,000 emergency heart attack patients in Massachusetts in 1987 and found that relative to the privately insured, the uninsured were 14 to 43% less likely to receive arteriography, coronary by-pass, or angiography. Wenneker et al. (1990) found similar results for nearly 38,000 potential cardiac patients in Massachusetts in 1985.

Similar results with very different data bases were found by Hadley, Steinberg, and Feder (1991), who analyzed a large national data base of hospital discharges; Kuykendall, Johnson, and Geraci (1995), who analyzed 24,424 hospital discharges for people with coronary artherosclerosis in California in 1989; and Carlisle, Leake, and Shapiro (1997), who used hospital discharges for African-Americans, Latinos, and Asians from Los Angeles County from 1986-1988. Two more recent studies (Canto et al., 2000, and Sada et al., 1998) used data drawn from the National Registry of Myocardial Infarction for over 332,000 people who had heart attacks between 1994 and 1996. Both found that the uninsured used fewer hospital resources and were significantly less likely to have received coronary by-pass, angiography, or angioplasty.

Daumit, Hermann, and Powe (2000) and Daumit and Powe (2001)analyzed data for almost 5,000 people who were being treated for ESRD in 1986-87 and had symptoms of cardiovascular disease. Those who had been uninsured at baseline were 24-30% less likely to have had a cardiac procedure compared to the privately insured; at follow-up, when all were covered by Medicare, the previously uninsured had a slightly higher rate of cardiac procedure use. One implication of these studies is that when the uninsured had both insurance coverage and a regular system of care through the treatment of their ESRD, their use of needed cardiovascular care was similar to those who had been insured prior to qualifying for Medicare coverage.

Three studies suggest some of the ways in which lack of insurance can influence cardiovascular treatment and outcomes. Bluestein et al. (1995) found similar results for a sample of 5,857 nonelderly patients with acute myocardial infarction (AMI) in California in 1991, explained in part by the fact that the uninsured were less likely to be

admitted to a hospital with revascularization capacity. Perlstein et al. (1997) looked at factors that influence the age at which children with congenital heart disease are referred to a pediatric cardiologist. Although the evidence is not definitive, it is believed that referral at an earlier age is associated with a better long-term outcome. In their analysis of 544 children they found that the referral delay was about twice as long for uninsured children compared to children with commercial insurance. Although limited to a small sample of 448 African-Americans admitted to two hospitals for chest pain, Ell et al. (1994) found that the uninsured delayed significantly longer in deciding to seek care for their symptoms, 11.2 hours compared to 7.8 hours for insured patients.

In contrast to these studies, one analysis of 3,006 possible heart attack patients seen in the emergency department of a single hospital found that insurance status had no effect on the admission of high-risk cases (Pearson 1994). However, uninsured medium- and low-risk cases were less likely to be admitted. While these results may reflect hospital policy rather than the general effects of insurance coverage, they also raise the possibility that the privately insured receive too many cardiovascular procedures and the uninsured are treated appropriately, i.e., the uninsured receive only necessary care while the privately insured receive unnecessary care.

Two studies have attempted to answer this question by reviewing medical records using accepted and validated criteria to judge whether the use of coronary procedures was medically necessary and appropriate. One study of 631 medically appropriate cases treated in 13 New York City hospitals found that there were no differences by insurance status in recommendations for coronary revascularization in the hospitals that had revascularization capacity, but in the hospitals that did not have this capacity, uninsured

patients were significantly less likely to have had coronary bypass or angioplasty recommended (Leape et al. 1999). The other study sought to determine the extent of over/underuse of coronary testing, again using explicit criteria to determine when such testing was appropriate (Carlisle et al. 1999). Using data for 356 people presenting with new cases of chest pain not due to myocardial infarction in five Los Angeles hospitals between 1994 and 1996, they found that coronary testing was more likely to be underused than overused, and that underuse was significantly higher among uninsured patients than insured patients (34% vs 15% ($p=0.01$), but not significant in multivariate regression models of the odds of underuse.) Although these studies involved relatively small samples in relatively few institutions, they imply that underuse of necessary services among the uninsured is more likely than overuse of unneeded procedures by the insured.

D. Cardiovascular Disease Outcomes

Two studies have analyzed acute myocardial AMI patients' mortality rates, comparing uninsured and privately insured patients. In a study of 4,972 emergency heart attack patients in Massachusetts in 1987, Young and Cohen (1991) found that among those discharged alive, the uninsured were over 50% more likely to have died within 30 days of discharge (unadjusted mortality of 13.1% compared to 8.3%). Canto et al. (2000) compared procedure use and outcomes for over 330,000 AMI patients included in a national registry between 1994 and 1996. They found about a 25% higher in-hospital mortality rate (as did Young and Cohen) for both uninsured and Medicaid patients, who also had significantly lower rates of coronary arteriography and revascularization.

In contrast to these studies, Sada et al. (1998) found no difference in adverse events between privately insured and uninsured patients, but a higher mortality rate among Medicaid patients, who had the lowest rates of invasive procedure use. Their sample, which came from the same national registry and the same time period as in the study by Canto et al. (2000), was smaller, 17,600 patients, but still large compared to most studies. However, the sample was limited to patients directly admitted to a hospital capable of providing invasive cardiac procedures. If the uninsured are less likely to be admitted to these hospitals, then the results may not be generalizable to all heart attack patients. Kreindal et al. (1997) also found no insurance-related differences in either procedure use or in-hospital mortality. However, their analysis was limited to 3,735 residents of a single community, Worcester, Massachusetts, who were hospitalized for acute myocardial infarction over a seven-year period, 1986-1993. Only 191 of their cases were uninsured.

Hadley, Steinberg, and Klag (1992) used data from the National Mortality Followback Survey on 534 nonelderly adults who had died of AMI in 1986 to investigate whether the uninsured died at a younger age than the privately insured. They found that the uninsured were two years younger at the time of death, were 1.8 times more likely to have died of their first AMI, and were half as likely to have been hospitalized in the last year of life.

Lurie et al. (1986, 1984) tracked a small sample of adults who had lost their Medicaid coverage in 1982 and found that those with hypertension at baseline had experienced a significant increase in their blood pressure levels. Although not a study of the effects of uninsurance per se, analysis of data from the National Health Insurance

Experiment of the mid-1970s found that among low-income people with high blood pressure, those who were assigned to the cost-sharing plans experienced significantly less reductions in blood pressure compared to those assigned to the free-care plan (Manning et al., 1987). It was estimated that the magnitude of the reduction implied an approximately 10 percent lower mortality risk in the free-care population.

Other research has provided evidence of the contribution of medical care to the dramatic reduction over time in mortality from heart disease. From an extensive review of the literature, Cutler, McClellan, and Newhouse (1998) concluded that "…changes in acute treatments such as use of aspirin, beta blockers, thrombolytic drugs, and (to a limited extent) invasive procedures account for a substantial part of the improvement in mortality." Similarly, Cutler and Kadiyala (1999) estimate that about one-third of the reduction in cardiovascular mortality over the last 50 years is due to changes in medical treatment…"Technological change in treatment of acute episodes and in pharmaceuticals to limit risk factors."

Hadley (1982) analyzed aggregate data on cardiovascular disease death rates among eight race-gender-age (45-64 and 65+) specific cohorts across U.S. county groups in 1970. Using instrumental variable analysis to adjust for the effects of poor health on medical care use and to compensate for the lack of data on medical care use at the individual level, he found a highly significant inverse relationship between per capita medical care use and mortality: a 10% higher level of per capita medical care use was associated with 1.5 to 4.2% lower mortality rates. Brooks, McClellan, and Wong (2000) analyzed hospital discharges for 30,000 AMI patients over age 40 hospitalized in Washington between 1988 and 1993. They found that self-pay (uninsured) AMI patients

had the largest one-year expected reduction in mortality from treatment. This result suggests that the self-pay patients may have received fewer services because of their presumed lack of insurance, and that those foregone services would have had a significant positive effect on their one-year survival.

Table 2 summarizes the studies of cardiovascular outcomes. Among those that find an association between positive outcomes and either having health insurance or greater use of medical care, one is derived from a randomized experiment (Manning et al. 1987), two were based on natural experiments (Lurie et al. 1986 and 1994), and one used instrumental variable analysis (Hadley 1982). Of the two studies that found no significant association between outcome and health insurance status, one was limited to a single community.

E. Diabetes, Renal Disease and Liver Disease Care and Outcomes

Diabetes - Using data from over 2000 adults identified as having diabetes in 1994 on the Behavioral Risk Factor Surveillance System, Beckles et al. (1998) found that the uninsured were less likely to use preventive services (dilated eye examination, self-monitoring of blood glucose, or professional foot examination) than people with any type of insurance coverage. (Relative odds ranged from 0.24 to 0.52 and were statistically significant for 5 of 6 services.) Ayanian et al. (2000) updated this analysis using the 1997 and 1998 Behavioral Risk surveys and confirmed significantly lower rates of dilated eye examination, professional foot examination, and cholesterol measurement among nonelderly, uninsured adults with diabetes.

In an analysis of health data on 1,480 diabetics screened between 1988 and 1994 as part of the National Health and Nutrition Examination Survey, Harris (2001) found in separate analyses by race and ethnicity that uninsured African-Americans were significantly less likely than those with any type of insurance to have low hemoglobin (OR = 0.3) and to have a low albumin-to-creatinine ratio (OR = 0.4). Uninsured Mexican-Americans were less likely than those with private insurance to have a low albumin-to-creatinine ratio (OR = 0.6).

Other smaller, single-site studies (Songer et al., 1997; Schiff et al., 1998) also tended to find deficiencies in screening and treatment for uninsured or poor diabetic patients. Wilson and Sharma (1995) reported that among a small sample (247) of diabetics hospitalized in Clark County (Las Vegas) Nevada in 1992 for acute emergencies associated with complications of diabetes, those without insurance were much more likely to have their admission associated with lack of medication.

Renal Disease - Several studies have found that lack of insurance is associated with poorer health among people with diabetes who develop end-stage renal disease. Obrador et al. (1999) analyzed data on health conditions for over 155,000 people who became eligible for Medicare's ESRD program between 1995 and 1997. Those who were uninsured at time of entry to the program were significantly more likely to have worse measures of several indicators of diabetics' health status. Controlling for age, race, gender, employment status, and mobility status, the uninsured (compared to those with private insurance at time of entry) were significantly more likely to have hypoalbuminemia (OR = 1.37), to have severe anemia (hematocrit < 28%, OR = 1.34),

and much less likely to have used erythropoietin (OR = 0.49). These factors all contribute to low survival rates.

Powe et al. (1999) studied the factors associated with hospitalization for septicemia, which is a significant predictor of subsequent mortality, in a longitudinal sample of people who entered the ESRD program in 1986 or 1987. Controlling for other factors, those who were being treated by peritoneal dialysis and were uninsured at entry were 2.69 times more likely to have episodes of septicemia. Pre-entry insurance status was not related to hospitalization for septicemia among hemodialysis patients, perhaps, according to the authors, because of their more frequent contact with outpatient medical providers.

Liver Disease - One study (Kim et al. 2001) investigated the association between source of payment and in-hospital mortality for people hospitalized for either hepatitis C or alcohol-induced liver disease (ALD). Based on logistic regression analysis of 26,700 hospitalizations in 1995, they found that people with "other" source of payment (self-pay and sources other than private insurance, Medicare, or Medicaid) had slightly higher, though statistically significant odds of in-hospital mortality compared to those with private insurance (OR = 1.33 for hepatitis C; OR = 1.18 for ALD). Table 3 summarizes research on insurance and health outcomes for people with diabetes, renal disease, or liver disease.

F. Trauma Care and Outcomes

Trauma care outcomes may be especially good indicators of the relationship between insurance status and health because the incidence of trauma may be relatively

unrelated to insurance status, and, as such, considered an exogenous shock to current health. Svenson and Spurlock (2001) analyzed data from 3,821 head trauma cases initially seen in four emergency departments in Kentucky between 1995 and 1997. They found that the uninsured were 41% as likely to be admitted as the privately insured, controlling for diagnosis, severity, age, race, and hospital. However, there was no difference in admission rates by insurance status for the most severe injuries.

Haas and Goldman (1994) analyzed 15,008 hospital records of all acute trauma cases between the ages of 15 and 64 in Massachusetts in 1990. Controlling for age, race, sex, severity of injury and comorbidity, uninsured patients were as likely as privately insured patients to receive intensive care, but were significantly less likely to have an operative procedure (odds ratio = 0.68). The uninsured were 2.15 times more likely to die in the hospital. (Medicaid patients were also less likely to receive an operative procedure, though the difference was not as great (odds ratio = 0.85) and there was no difference in their in-hospital mortality compared to the privately insured.)

G. Other Conditions: Cystic Fibrosis, Ruptured Appendix, Pneumonia, and Ventilator Support

Cystic fibrosis is a relatively rare genetic condition occurring in approximately 1 in 2,500 births. Although life expectancy is still very short, with median survival of only 28 years as of 1994, it has increased substantially over the last thirty years, from only two years in the early 1960s. Much of this increase in survival has been attributed to improved drug treatment and the establishment of specialized, multidisciplinary treatment centers. Curtis et al. (1997) developed a retrospective database of 189 patients with cystic fibrosis who had been born between 1955 and 1970 and had been hospitalized at

least once at a university medical center. Controlling for parents' socio-economic status, age at diagnosis, gender, and clinical characteristics, median survival for patients without health insurance was 6.1 years, compared to 20.5 years for those with private insurance. Since this study does not meet the general criteria for inclusion in this review, its findings must be qualified by the limitations of a small sample and data from a single institution. However, it also appears to be unique in its analysis of a genetic condition whose occurrence is unlikely to be correlated with insurance status.

Another condition whose onset is unlikely to be related to health insurance status is appendicitis. Braveman et al. (1994) assessed hospital discharge data for 96,587 nonelderly adults who were hospitalized for acute appendicitis in California between 1984 and 1989. Controlling for demographic, health, and hospital characteristics, they found that uninsured patients were almost 50% more likely to experience a ruptured appendix compared to cases with private insurance coverage. Hadley and Steinberg (1996) also analyzed hospital discharge data, but from 12 states, including California, for years between 1988 and 1991, and obtained a similar result for uninsured children between the ages of 6 and 18 and uninsured adult women between the ages of 19 and 50. (There was no difference for children younger than 6 and adult men were not analyzed.)

Gadomski and Jenkins (2001) also found that self-pay children in Maryland had a greater relative odds (1.11) of ruptured appendix compared to privately insured children between 1989 and 1992, and no difference between Medicaid and private insurance. However, the odds ratio in their study was not significantly different from 1.00. This may be due to a combination of Maryland's hospital rate setting system, which implicitly

subsidized hospitals for costs of care to uninsured people, and perhaps because of their relatively smaller sample size of 5,141 cases.

Yergen et al. (1988) analyzed hospital data for 4,369 people admitted with a diagnosis of pneumonia to 17 hospitals between 1970 and 1972. They used linear regression models to estimate expected service use and in-hospital death based on demographic and health characteristics from admissions records. They then calculated ratios of observed-to-expected outcomes for patients grouped by source of payment. Observed use of radiographic procedures was half of what was expected for self-pay (uninsured) patients, compared to 7% less than expected for Blue Cross patients. Use of consultations and surgical procedures was also lower than expected for self-pay patients relative to Blue Cross patients, although intensive care use was higher than expected. Nevertheless, observed in-hospital mortality was 1.38 times greater than expected for the self-pay patients, compared to 14% lower than expected for Blue Cross patients.

Finally, Schnitzler et al. (1998) examined data 21,149 nonelderly adults who had received ventilator support for a range of respiratory diagnoses in a national sample of hospitals between 1989 and 1992. Controlling for age, gender, race, area income, and hospital characteristics, uninsured patients had a statistically significant, lower in-hospital mortality rate than the privately insured (OR = 0.87). However, by analyzing only cases that received a particular treatment, rather than all cases with the underlying diagnoses, this result seems especially susceptible to possible selection effects that influenced whether uninsured patients received ventilator support. In particular, it is possible that the uninsured who did not receive ventilator support had higher in-hospital mortality than insured patients not receiving ventilator support, or that only the most healthy uninsured

patients with a high expected survival received ventilator support. The results of the studies of trauma care and of the other diseases and conditions presented in this section are summarized in Table 4.

CHAPTER 5 - INSURANCE, MEDICAL CARE USE, AND ADULTS' GENERAL HEALTH OUTCOMES

A. Failure to Obtain Needed Services

Many people believe that the uninsured receive the care they need or, if they don't receive care, that they do not suffer serious health consequences. Surveys conducted in 1999 and 2000 found that a majority of Americans, 57%, believed that "the uninsured are able to get the care they need from doctors and hospitals," up from 43% in 1993 (Blendon, Young, and DesRoches, 2000). Only 19% felt that the uninsured cannot get care and that they experience serious health consequences. However, almost as many Americans, 12%, believed that those unable to get care do not suffer serious health consequences.

Contrary to these perceptions, studies have consistently found that the uninsured are less likely to obtain services (e.g., see a doctor or fill a prescription) when they have a perceived "need for care." Although these studies do not identify specific health conditions, their findings are conditioned on a population that believes they have a medical problem that requires attention. For example, a recent national survey found that 20% of the uninsured, but only 3% of the insured, "Needed, but did not get care for a serious problem in the past year (Kaiser Commission, 2000)." Other national surveys conducted in 1997, 1996, and 1986 have found very similar results (Schoen and DesRoches, 2000; Freeman et al. 1990). Similarly, national surveys conducted by the Center for Studying Health System Change in 1997, 1999, and 2001 found a three- to four-fold difference in the proportions of uninsured people reporting an unmet health need compared to the insured (Strunk and Cunningham 2002; Cunningham 2002).

Comer, Mueller, and Blankenau (2000) analyzed data for 5,530 nonelderly adults in Nebraska. Lack of insurance, whether continuous or partial, was associated with significantly lower use of needed medical care. Baker, Shapiro, and Schur (2000) analyzed data for 574 people who reported new serious or morbid conditions on a national survey conducted in 1994. The uninsured were less than half as likely to have received any care and only a fourth as likely as the insured to have received care they thought was necessary for their new condition. Hafner-Eaton (1993) used data from the 1989 National Health Interview Survey to compare the probability of a physician visit in insured and uninsured nonelderly populations stratified by general health status and the presence of chronic or acute illnesses. He found that the uninsured had a consistently lower probability of seeing a physician. The difference in probabilities was largest (18.8%) among people with chronic health conditions who reported their overall health status as poor, and smallest (4.4%) among people with acute illness in poor overall health status. Overall, uninsured chronically ill people were half as likely to have had a physician visit in the last year (OR = 0.5). The disparity was smaller for uninsured acutely ill people (OR = 0.62), but still significant.

Although not explicitly linked to the concept of needed services, Burstin, Lipsitz, and Brennan (1992) found that the uninsured were more than twice as likely as the privately insured to receive substandard care, defined as adverse events due to negligence, when hospitalized. Their conclusion was based on the review and analysis of over 30,000 medical records from 51 New York hospitals in 1994. Moreover, the analysis controlled for hospital characteristics as well as underlying risk and other patient

characteristics, suggesting the patient's insurance status rather than the choice of hospital was the primary reason for the observed difference.

Three other studies provide information about possible mechanisms underlying differences in care received by uninsured and insured people. Weissman et al. (1991) surveyed 12,068 patients drawn from consecutive admissions to five Massachusetts hospitals in 1987. Overall, 16% of patients delayed seeking care. However, the uninsured were significantly more likely than the privately insured to delay seeking care (OR = 1.7), and were substantially more likely to report that high cost was the reason for their delay (OR = 9.5). Thomas et al. (1996) interviewed 1,386 patients in a study of noncompliance following an emergency department visit (during 1993 at five study hospitals) for several specific conditions. They found that lack of insurance was significantly related to failure to fill recommended prescriptions (OR = 2.4). Lastly, Mort et al. (1996) analyzed clinical scenarios administered to a national sample of 1,182 physicians. They found that physicians were significantly less likely to recommend services for uninsured patients than for insured with identical clinical scenarios. They also found that the differences were greater for "discretionary" services than for "necessary" services. The latter finding supports the hypothesis that some of the higher service use observed by insured patients may not be for clinically needed services.

B. Medical Care Use and Adults' General Health Outcomes

Numerous studies have demonstrated that the insured use more medical care than the uninsured (Office of Technology Assessment, 1992; Marquis and Long, 1994; American College of Physicians, 2000). Is there evidence that greater use of medical

care improves health? The next two sections review studies that have generally found a positive association between greater medical care or having insurance and adult health (e.g., lower mortality rates). In the third section of this chapter, the substantial literature that has failed to find a positive association between either greater medical care use or having health insurance and adults' general health is summarized. Differences among these studies and their implications for the issue of extending health insurance coverage to the uninsured will be discussed in the report's concluding chapter.

B.1 Studies that Imply More Medical Care Use Is Associated with Better Health

In one of the very first studies to examine the relationship between health care spending and mortality, Auster, Leveson, and Sarachek (1969) analyzed relatively crude state-level data, and found that a 10% higher level of medical spending per capita was associated with a 1.2% lower age-adjusted mortality rate when they estimated the relationship using an instrumental variable method to adjust for the influence of health on medical care use. (Without the adjustment, the estimated effect was about half as large.) Hadley (1982, 1988) used a very similar analytic approach applied to better quality data (from the 1970 and 1980 Censuses) for small areas (county groups), and estimated effects of roughly the same magnitude. In 1970, a 10% higher level of per capita medical spending (approximated by data on Medicare spending per beneficiary) was associated with a 0.7% to 3.2% lower mortality rate among age-sex-race specific adult population cohorts (and a 1.5% to 2.0% lower mortality rate among race-sex specific infant cohorts). In 1980, looking only at variations in Medicare spending, he found that a 10% higher

level of Medicare spending per beneficiary was associated with 2.5% to 10% lower mortality among age-sex-race specific cohorts of elderly people.

Lichtenberg (2001) exploited the nearly universal eligibility for Medicare coverage at age 65 as a natural experiment of the relationship between medical care use and morbidity and mortality, since health does not affect Medicare eligibility. Using several data sources, he found evidence that both ambulatory care and, to a smaller extent, inpatient care increase sharply at age 65 relative to what would be expected based on the trend prior to age 65. Relative to projected levels of morbidity (days in bed) and mortality based on pre-age-65 trends, actual morbidity and the age-specific probability of death are about 13% lower. The estimated long-run effect of a 10% increase in physician visits, which can be taken as a proxy for medical care use generally, is a 5% reduction in the mortality rate. This estimate falls within the same range estimated by Hadley (1988) for the relationship between variations in Medicare spending and elderly mortality rates.

Lichtenberg (2002) has also estimated a simple health production model that seeks to identify the contributions of health spending per capita and new drug approvals (as a proxy for medical innovation) to increases in longevity at birth (the inverse of the mortality rate) for the entire population over the period 1960 to 1997. Both factors were statistically significant across several variants of his basic model. A 10% increase in health spending per capita is estimated to increase longevity by 0.7-0.9%, or almost 1%. The larger estimate is based on a model that uses expenditures in the previous year as an instrument for current year expenditures, which may be influenced by current year

mortality.[4] The estimated effect is at the lower end of those found in earlier studies, but applies to people of all ages, not just older adults or infants.

On average, these findings conservatively suggest that a 10% increase in medical spending might reduce mortality rates by 1-3%. The three cross-sectional studies used instrumental variable analysis to adjust for the problem of reverse causality, while Lichtenberg (2001) exploited the natural experiment of most people qualifying for Medicare coverage at age 65, independently of any other health or personal characteristics. Thus, even though these analyses are not true experiments or randomized trials, their statistical methods and structure provide some reassurance that the results are not biased.

B.2 Studies that Imply that Having Health Insurance Is Associated with Better Health

Several studies have found statistically significant evidence that having health insurance is associated with a lower risk of mortality. Two analyses tracked mortality experiences over time by insurance status, uninsured or privately insured, at baseline. Using data on 147,779 adults interviewed by the Current Population Surveys in 1982-85 and linked to national mortality data, Sorlie et al. (1994) found that except for African-American adult women, other uninsured adults were from 1.2 to 1.5 times more likely to have died after five years. Franks et al. (1993) analyzed data for 4,694 adults from the 1971-75 National Health and Nutrition Examination Survey and estimated that an uninsured adult's relative risk of death was 1.25 times higher than a privately insured person's. They also found that over a 17-year period, nearly twice as high a proportion of

[4] The statistical estimates are also adjusted for possible bias due to correlations over time in the data.

the uninsured had died, 18.4% of the uninsured compared to 9.6% of the privately insured. These findings are especially noteworthy because these studies measured health insurance only at baseline, which would tend to decrease survival differences. (Some of those who were uninsured at baseline probably gained insurance over the observation period, and some of those insured at baseline probably lost coverage.) Thus, there is reason to believe that the differences in health outcomes between uninsured and insured adults may even be larger than reported by these studies.

Two other recent longitudinal studies provide further evidence of a positive relationship between having health insurance and better health. Baker et al. (2001) tracked a cohort of 7,577 older middle-aged adults from the National Health and Retirement Survey between 1992 and 1996. People who were uninsured at all three observation points were 1.63 times more likely than the "continuously" insured to have a "major health decline" (including death); for those with "intermittent" insurance coverage, the odds ratio was 1.41. Both groups without continuous insurance coverage were also more likely (OR = 1.23-1.26) to develop mobility limitations, i.e., difficulty walking or climbing stairs. Kasper, Giovannini, and Hoffman (2000) followed a relatively small sample of 724 adults who either gained (n=443) or lost (n=281) coverage status between 1995 and 1997. Although the differences were not statistically significant, those who gained insurance were less likely to report fair or poor health status in the second period, while those who lost insurance or were uninsured throughout were more likely to report fair or poor health in the second period.

Using cross-sectional data for over 600,000 hospital discharges in 1987, Hadley, Steinberg, and Feder (1991) found that in 12 of 16 age-sex-race specific population

groups, the uninsured had a significantly higher in-hospital mortality rate than the privately insured. Bradbury, Golec and Steen (2001) conducted a similar analysis of 29,237 nonelderly adults admitted for 19 high-frequency diagnoses to a national sample of 100 hospitals in 1993-1994. They found that compared to privately insured patients, the uninsured were significantly more likely to be admitted for conditions with a higher expected mortality (OR = 1.13) and more likely to be admitted from the emergency department (OR = 1.82). Controlling for expected mortality, the uninsured were significantly more likely to die before discharge (OR = 1.37) or to leave against medical advice (OR = 4.74).

Two other cross-sectional studies have found a positive relationship between having health insurance and health status. In an analysis of almost 54,000 working adults from the 1999 CPS, Fronstin and Holtmann (2000) found that workers with insurance were from 5-8% more likely to report themselves in good health. (The estimates varied with gender, full- or part-time employment status, and the size of the firms they worked in.) Franks et al. (1993), who analyzed data from the 1987 Medical Expenditure Survey, found that the insured had significantly higher subjective health status than the uninsured, even after controlling for age, race, sex, income, and attitudes about health.

Finally, although their sample was small, a study by Fihn and Wicher (1988) investigated the effects of losing free coverage for routine outpatient care from the Veterans Administrations. For the purposes of this review, this study can be considered a natural experiment because the loss of coverage was based on a budget shortfall at the Seattle VA Medical Center, rather than on individuals' decisions that might have been based on their health. The study followed 157 people who met carefully assessed

medical criteria for being in stable medical condition at the time of discharge and 74 comparison subjects who were in similar health and retained coverage. After 17 months of follow-up, 41% of the discharged patients reported their health to be "much worse," compared to 8% of the comparison group ($p<0.001$). Almost twice as many of the discharged patients had reduced use of prescribed medications (47% vs 25%), and among those who had a blood pressure check at 13 months of follow-up, 41% of the discharged patients had uncontrolled high blood pressure compared to 17% of the comparison group.

The consistency of these two strands of research, one looking at health insurance and measures of adults' general health and the other at medical care use and health, can be compared by using information from other research on the effect of health insurance on medical care use. Marquis and Long (1994) report that having health insurance increases medical care use by about 50%. Combining this estimate with the result from the previous section that a 10% increase of medical care spending is associated with a 1-3% decrease in mortality rates, a 50% increase in medical care use would be expected to reduce mortality rates by 5-15%. This range is very consistent with, albeit somewhat lower than the range of estimates found by the Sorlie et al. (1994) and Franks et al. (1993) studies of the relationship between health insurance and mortality. Given the broad range of data, populations, time periods, statistical methods, and measures in these studies, this consistency provides reassurance that the results are not spurious or due to underlying bias from reverse causality or unobservable variations in underlying characteristics.

B.3 Studies that Fail to Find a Positive Association between Medical Care Use or Insurance Coverage and Adults' Health Outcomes

Although there is a considerable body of research suggesting that having health insurance or using more medical care improve health, these studies are not definitive nor are their findings universal. In order to gauge the weight of the evidence, it is important to summarize the studies that conclude that health insurance status or medical care use do not affect adults' health. Are there fundamental differences in these studies compared to the studies already reviewed? Can the results from the two bodies of research be reconciled in any way?

As an example of the research that fails to find a positive relationship between good health and either more medical care use, greater resource availability, or health insurance coverage, Ross and Mirowsky (2000) concluded "Private medical insurance is not associated with good health outcomes, adjusting for baseline health and socio-demographic characteristics, and public insurance is associated with worse health." Although their conclusions were based primarily on their own statistical analysis (discussed below), they also cite two other streams of research. One consists of "small area" studies, such as Fisher et al. (2000), Fisher et al. (1994) and Wennberg et al. (1989), that failed to find that greater hospital use by Medicare beneficiaries is associated with lower elderly mortality rates. The second is a set of earlier research that generally concluded that what people do to and for themselves in terms of health behavior and health habits influence health much more than do variations in the use of medical care.

Ross's and Mirowsky's (2000) strong conclusion about the ineffectiveness of health insurance merits detailed evaluation. It was based on multivariate regression models of self-assessed health status, physical functioning, and number of chronic

conditions estimated with data from a relatively small longitudinal sample of 1,451 people who were interviewed in 1995 and 1998. Their analysis combined both elderly (42% of the unweighted sample) and nonelderly adults into a single sample. Given the very strong associations between age and poor health, on the one hand, and age and Medicare coverage on the other, it is unlikely that the estimated effects associated with Medicare coverage can be interpreted unambiguously as the effect of public insurance coverage on health.

Second, 44 percent of the baseline sample could not be reinterviewed. Although the analysis claimed to control for attrition hazard, this is an especially large sample loss, which presumably includes people who died. If uninsured adults have a higher expected mortality rate, as suggested by many of the studies reviewed above, then failure to include death as an adverse health outcome limits the conclusion that insurance coverage does not affect health.

Third, and most significant, the study does not explicitly correct for the effects of poor health on insurance coverage. The most obvious example of this is the relationship between old age or disability and Medicare coverage. If older people are more likely than younger people to experience a health decline over a given period of time strictly as a function of age, then this would underscore an apparent association between Medicare and health decline, even if age is included in the model as a control variable. An even stronger negative association with health will occur for non-elderly adults covered by Medicare, since their Medicare coverage is obtained because of either being disabled or having end-stage renal disease. Similarly, Medicaid coverage, the other type of public insurance in their analysis, is also frequently associated with poor health, either because

of poverty caused by illness or disability, or because of very low socioeconomic status that jointly causes both poor health and qualifies one for Medicaid eligibility.

As will be discussed more fully in Chapter 7, as many as 40-50% of adults insured by Medicaid have coverage because of poor health, qualifying because of either disability or medical spend-down. More generally, Hahn and Flood (1995) found that in a large, national cross-section of nonelderly adults, those covered by Medicaid were in significantly poorer heath than the uninsured. When the sample was limited to low-income people who would be more likely to qualify for Medicaid through cash assistance, there was no difference in health status between people on Medicaid and the uninsured. Holahan (2001) found similar differences in health status for Medicaid recipients relative to both the uninsured and the privately insured (of all incomes). Thus, there is good reason to suspect that potential endogeneity bias in the Ross and Mirowsky (2000) study was not offset by the observable data on baseline health differences. (Several studies suggest that endogeneity bias can persist even with controls for observable health differences, and that both sample size and the extent and richness of the observable health data are important. See, for example, McClellan et al., 1994; Hadley et al, 2000; Hadley et al., 2001; McClellan and Newhouse, 2000; Malkin, Broder and Keller, 2000).

Examples of other contradictory studies (summarized in Chapter 4) are Kreindal et al. (1997), who studied outcomes from acute myocardial infarction, and Schnitzler et al. (1998), who analyzed patients on ventilator support. The former study, which was limited to people residing in a single community, Worcester, Massachusetts, did not find a significantly higher in-hospital mortality rate for uninsured patients compared to the

privately insured. However, more than half of their sample consisted of elderly people covered by Medicare and only 191 people were uninsured. Young and Cohen (1991), who did find worse outcomes for uninsured heart attack patients in Massachusetts, excluded Medicare beneficiaries from their sample. In addition, Worcester is near the University of Massachusetts' Medical School, which may have been more willing to treat patients regardless of insurance status than hospitals in other parts of the state.

Schnitzler et al. (1998) found that uninsured patients on ventilator support had lower inpatient mortality than the privately insured. However, their analysis also included Medicare patients, who made up 25% of the total sample. More importantly, receipt of ventilator support is a medical service that is itself likely to be influenced by insurance status. If the uninsured are less likely to receive ventilator support for a given medical condition, as implied by many of the studies reported in section IV.1, then this result is probably distorted by a form of selection bias.

Most of the small-area studies (Fisher et al. 2000; Fisher et al. 1994; Wennberg et al. 1989), which compare resource use and outcomes across either specific communities or hospital service areas, also suffer from two possible weaknesses. One is that the simple demographic adjustments, typically for differences in the age-gender-race distributions of area populations, are inadequate controls for variations in underlying health status. For example, a small-area study of elderly women's breast cancer treatment found that a more direct measure of underlying health, the number of comorbid conditions reported on hospital claims data, varied much more across small areas than did the age and race distributions of this population (Hadley et al., 2001). The other weakness of these studies is that most of them fail to adjust at all for the confounding

effects of unobservable variations in health on both resource use (hospitalization rates) and mortality rates. Thus, one cannot rule out the possibility that the results of these studies are due to systematic differences in unobservable underlying health that explain both higher hospital use and higher mortality rates.

An important methodological exception to this body of work is the study by Skinner, Fisher, and Wennberg (2001), who used instrumental variable analysis to relate Medicare expenditures per beneficiary to survival rates across 306 hospital referral regions in 1996. They used the average number of physician visits made by beneficiaries in their last six months of life, which varied almost twofold between the upper and lower terciles of their regions, to identify variations in treatment intensity due to factors other than health, since all of the cases used to create these groupings died. They found that there was virtually no difference in survival rates associated with variations in treatment intensity, and concluded that the marginal benefit of additional treatments may be close to zero.

The inconsistency between this study's findings and other instrumental variable analyses that found significant positive associations between medical care use and health could be due to any number of specific methodological considerations, such as differences in the quality of the instruments used, sample sizes, units of analysis, time periods, and the specific measures of medical care use and outcomes. The more important point, however, is that a finding of low marginal benefit from additional medical care use **by a well-insured population** does not necessarily imply that the uninsured, who receive significantly less care than the insured, would not benefit from greater medical care consumption. In fact, if inefficient consumption by the well insured,

estimated to be $26 billion in Medicare in 1996 (Skinner, Fisher, and Wennberg, 2001), could be reduced, then substantial resources could be redirected to subsidize the cost of insurance for the low-income uninsured.

The only controlled experiment of health insurance structure, medical care use and health was the RAND Health Insurance Experiment (Newhouse et al., 1993). In general, it found that differences in coinsurance rates did affect the use of medical care, but these variations in medical care use had limited affects on health outcomes for the average participant. As noted in Chapter 4.D above, however, the experiment also found that the health of the "sick poor," approximately six percent of the overall population, was adversely affected by lower medical care use (Newhouse et al., 1993, p. 339). Especially notable was an approximate ten percent reduction in the probability of dying for people in the free-care plan compared to the cost-sharing plan (p.211). This comparison may actually understate the effect of insurance coverage, since the cost-sharing plan encompassed several levels of cost sharing, while an uninsured person faces a 100% cost-sharing rate.

Several early studies (such as Fuchs 1974; Glazer 1971; McKinlay and McKinlay 1977; Illich 1976; Newhouse and Friedlander 1980; and McDermott 1981) contributed to the pervasive perception that medical care has little impact on health. However, this general conclusion, which may be true for the average insured person in the short-run or cross-sectionally, does not necessarily apply to the average uninsured person, who may be sicker than the average insured person and consuming significantly less medical care. In other words, even if the marginal benefit to the average, relatively healthy, privately insured person is close to zero (with a static medical technology), it does not follow that

the benefit is also zero for an infra-marginal person, i.e., someone without insurance. (See Brooks, McClellen and Wong (2000) , who developed explicit estimates of the marginal benefits of heart attack treatments for different payer groups and found that the uninsured had the largest expected benefit from additional treatment.)

These early studies can also be criticized on methodological grounds, since their primary statistical analysis was typically little more than casual empiricism, comparing broad trends or variations in levels of medical resources against broad mortality indicators. Adjustments were generally not made for the effects of poor health on resource availability or intra-area/temporal variations in who was actually using medical care.

Another problem is extrapolating from the time periods covered by these studies. Most were based on data from roughly 1970 or earlier, either predating or including only the first few years of Medicare and Medicaid, before these programs had substantial and sustained impacts on medical care use by their beneficiaries. Perhaps even more importantly, these time periods precede the undoubtedly substantial effects of expanded public insurance coverage on the rate of innovation in medical technology.

In an analysis of the changing age distribution of mortality over the twentieth century, Cutler and Meara (2001) show that the rate of improvement in longevity at birth did indeed slow down substantially over the period 1945-1965, as observed by Fuchs (1974), Glazer (1971), and others writing in the early 1970s. Cutler and Meara (2001) then go on to show that that rate of improvement in longevity at birth accelerated after roughly 1965, due primarily to significant improvements in the medical treatment of low birthweight infants and older adults with cardiovascular disease. Their analysis suggests

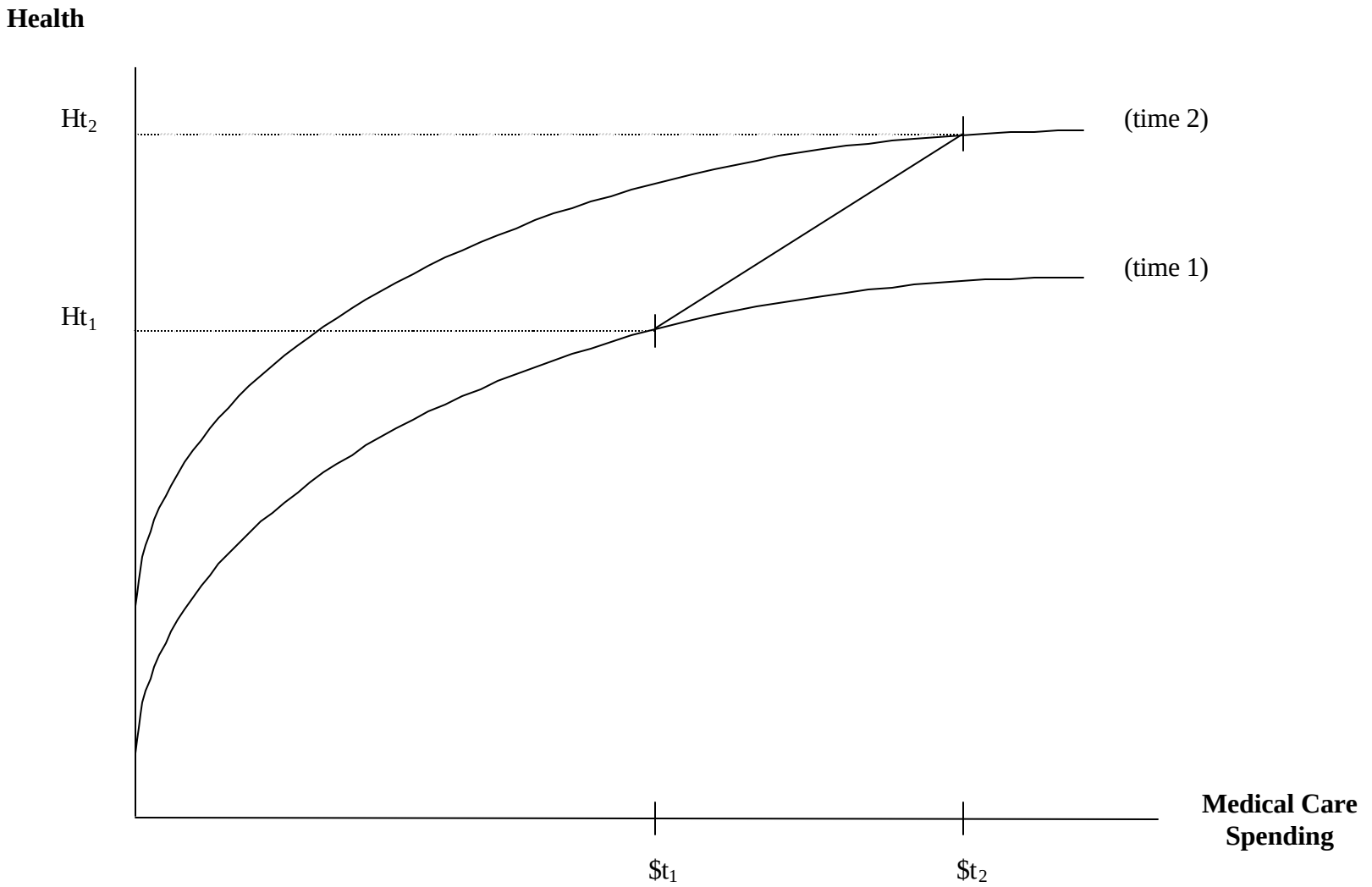
that simple extrapolation of the longevity trend observed for 1945-1965 would have significantly understated actual increases in longevity.

Over time, improvements in technology have had an enormous impact on improved longevity and health status. Figure 2, adapted from Cutler and Richardson (1999), suggests that even if the marginal value of additional consumption is very low at a particular point in time, upwards shifts of the entire health "production function' over time can lead to significant health improvements as medical care use and spending increase. This point is also made by Skinner, Fisher, and Wennberg (2001).

These different bodies of research on medical care use, insurance status, and adults' general health outcomes are summarized in Table 5. Almost all of the adult health studies that found no relationship between medical care use or resource availability and mortality investigated the Medicare population at a point in time. Only one study, which has several serious methodological flaws, found no relationship between having health insurance and health. Together, however, these studies suggest that cases of excess, unproductive medical care use, i.e., "flat-of-the-curve" medicine and cases of potentially high marginal benefit can occur at the same time, but in different populations (Cutler and Richardson 1999). In other words, these studies are not necessarily contradictory, but apply to either different populations (the elderly or the well-insured nonelderly) or to a different time when medicine's potential to improve health may have been lower than it is today.

Figure 2

Marginal and Average Effects of Medical Care Use Over Time



CHAPTER 6 - INSURANCE, MEDICAL CARE USE AND BIRTH,CHILD, AND MATERNAL HEALTH OUTCOMES

Insurance coverage of pregnant women, infants and children has increased in recent years, due primarily to expanded Medicaid eligibility starting in the late 1980s and the establishment of the State Children's Health Insurance Program (SCHIP) in the late 1990s. Following the same framework applied to the review of studies of specific diseases, this chapter's first section summarizes studies of the relationship between insurance and the use of birth-related medical care services (pre-natal care, cesarean section deliveries, neonatal intensive care units) and childhood medical care use. The second section examines research that has investigated whether greater service use or having health insurance are associated with better birth outcomes. This section is organized by birth outcome measure: gestation, birthweight, and survival, which itself has multiple dimensions (fetal, neonatal, post-neonatal, and infant). Gestation and birthweight have been used as outcomes because of their strong association with infant survival. The chapter's third section considers studies of maternal and child health by insurance status.

The reviews in this chapter give explicit attention to analyses of the effects of Medicaid expansions and to studies that use instrumental variable estimation methods. The Medicaid expansions represent an important set of natural experiments of the impact of extending public insurance coverage. Estimating statistical relationships using instrumental variable analysis is particularly important because pregnant women's choices about when to begin prenatal care, whether to terminate pregnancy, and whether to seek Medicaid coverage are all potentially inter-related with each other and with

expectations about likely birth outcome. In addition, birth outcome and prenatal care/insurance decisions may both be influenced by unobservable or difficult-to-measure differences in attitudes and socio-economic factors. Instrumental variable analysis is one approach to adjusting for the effects of these factors when randomization is not possible.

A. Insurance Status and Birth-Related/Childhood Medical Care Use

Birth-Related Medical Care Use - Numerous studies have found that uninsured pregnant women receive less prenatal care than privately insured pregnant women. (See American College of Physicians (2001) and Office of Technology Assessment (1992) for earlier summaries of this literature.) For example, Braveman et al. (1993) analyzed 593,510 singleton live births in California in 1990 and found that compared to the privately insured, uninsured mothers were significantly more likely to have had late initiation of prenatal care (OR = 2.54), too few prenatal visits (OR = 2.49), or no prenatal care at all (OR =6.7).

Since studies of administrative records do not have any information about mothers' attitudes, the research by Kalmuss and Fennelly (1990) provides valuable confirmatory evidence of the importance of insurance coverage. They interviewed 496 African-American and Hispanic women who delivered babies in six New York City hospitals in 1985-86, and found that lack of health insurance was still a significant predictor of late initiation or no prenatal care, even after controlling for differences in motivation and attitudes about prenatal care, substance abuse, and other socio-demographic factors.

While there are fewer studies of variations in care received by newborns, the evidence also suggests that uninsured newborns receive less care than the privately insured. Braveman et al. (1991) analyzed resources received by sick newborns (N=29,751), defined as newborns who were discharged with evidence of serious problems from California hospitals in 1987. They found that uninsured newborns had more severe medical problems than privately insured newborns, but received significantly less care, measured by either length of stay (16%), total charges (28%), or charges per day (10%). (Medicaid-covered newborns also had more severe conditions, but received an intermediate quantity of care.)

Other research has focused on the relationship between high-risk births and the method of delivery, C-section versus vaginal delivery. For example, C-section delivery is generally indicated for breech presentation in delivery, which is considered an important risk factor for an adverse birth outcome. Aron et al. (2000) applied 39 risk factors to 25,697 women who gave birth at 21 Ohio hospitals between 1993 and 1995 to divide women into risk-factor quintiles. Uninsured women in the two most risky quintiles were 20-30% less likely to have had C-section deliveries compared to privately insured women.

Stafford (1990) examined over 460,000 deliveries in California in 1986 and found a significantly lower C-section rate for self-pay and indigent care patients relative to the privately insured, even for women with breech presentations, which is a strong indicator for C-section delivery: 90% of the privately insured with a breech presentation delivered by C-section, compared to 82% of self-pay and 79% of indigent care women. As part of an evaluation of a Massachusetts health care program, Haas, Udvarhelyi, and Epstein

(1993) analyzed singleton births in Massachusetts in 1984 to compare C-section use between uninsured and privately insured women. Uninsured women had lower use of C-section deliveries, 17.2% vs 23.0%. Onion et al. (1999) found a similar, though smaller differential between uninsured and privately insured women who gave birth in rural northern New England (Maine, New Hampshire, and Vermont) between 1990 and 1992.

To some extent, these findings may be due to uninsured women's hospital choices. Studies by Bronstein et al. (1995) and Schwartz et al. (1999) suggest that the link between insurance-induced increases in the adequacy of prenatal care and better birth outcomes is not the content of prenatal care per se, but better access to high technology services for high-risk newborns.

Children's Medical Care Use - Newacheck et al. (1998) found differences in the use of care for insured and uninsured children using data from the 1993-94 NHIS. Uninsured children were less likely to have a regular source of care, less likely to have seen a physician in the last year, and more likely to have gone without needed medical care. McCormick et al. (2000) used data from the 1996 Medical Expenditure Panel Survey to show that uninsured children were about two-thirds as likely as privately insured children to use any prescription medicines. Research also suggests that the children of uninsured parents are less likely to see a physician than children of insured parents (Hanson 1998) and less likely to have any visit or a well-child visit, even if the child is insured (Davidoff et al. 2002).

In studies of children enrolling in expanded state health insurance programs in western Pennsylvania and western New York, researchers found that uninsured children had considerable unmet need and delayed care, were less likely to have had any

prescriptions in the last 12 months, were less likely to have received recommended care, and were more likely to never have had routine care and to not be up to date with well-child care (Lave et al. 1998a; Holl et al. 1995). A small survey of 202 physicians in Milwaukee indicated that physicians vaccinated uninsured children less often than insured children (Arnold and Schlenker 1992).

When such comparisons are limited to children with specific health conditions (pharyngitis, acute earache, recurrent ear infections, or asthma), the results are similar (Stoddard, St. Peter, and Newacheck 1994). After controlling for various socio-economic factors, uninsured children were significantly more likely than insured children to go without any physician care for each of the conditions. (Odds ratios were 1.72 for pharyngitis, 1.85 for acute earache, 2.12 for recurrent ear infections, and 1.72 for asthma.). Overpeck and Kotch (1995) and Overpeck et al. (1997) analyzed data from the child health supplement of the 1988 National Health Interview Survey and found that uninsured children were significantly less likely to have injuries, both serious and not serious, that received medical attention (OR = 0.73-0.76 for all injuries and 0.71 for serious injuries).

B. Birth-Related Medical Care Use and Birth Outcomes

A number of studies have found that early initiation of prenatal care or the adequacy of prenatal care are significantly related to better birth outcomes. Several of these studies also show that failing to adjust statistically for the underlying effects of poor health on both birth outcome and prenatal care use produces confounded results that suggest no relationship between prenatal care and birth outcome. One complication in

assessing these studies is that they use a variety of measures of both birth outcomes and birth-related medical care use.

B.1. Gestation

Harris (1982) specified a statistical relationship in which prenatal care visits and pregnancy termination (fetal death, premature delivery, or full-term delivery) were treated as jointly determined, since analysis of the health of babies actually born would be based on a population at least partially self-selected by the mother from the population of all pregnancies. He also noted that the amount of prenatal care received depends on the duration of the pregnancy, i.e., women who deliver prematurely will have fewer prenatal visits than women with longer pregnancies, even if they initiated prenatal care at the same time. Thus at any point during the pregnancy, the risk of termination and the probability of having a prenatal care visit are competing events. Using data from 6,736 African-American women who either gave birth or experienced a fetal death in Massachusetts in 1975-76, his model suggested that prenatal care had no effect on fetal growth per se, but it did reduce the odds of pre-term delivery because premature labor can sometimes be attenuated by medical intervention. He estimated that timely initiation of prenatal care is equivalent to approximately an additional week of gestation.

Rosenzweig and Schultz (1982) also recognized that women make choices to some extent about when to initiate both pregnancy and prenatal care, as well as about health behaviors during pregnancy. In their statistical model, they approximate these behaviors by treating mother's age, number of prior births, smoking, and delay in initiating prenatal care as jointly determined outcome variables, along with gestation and

birthweight. They estimated their models using data from the 1967-69 National Natality Followback Surveys, both with and without statistical corrections (instrumental variables) for joint determination of pregnancy outcome and the other decision variables. With the statistical correction, they found that delay in initiating prenatal care was significantly related to shorter gestation. Without the statistical adjustment, their model suggested no effect of prenatal delay on gestation. They estimated that a six-month delay in initiating prenatal care reduced gestation by about 1.6 weeks (4%).

Ray, Mitchell and Piper (1997) investigated the effects of the expansions of Medicaid coverage to pregnant women in Tennessee in the late 1980s. From data on over 600,000 births between 1983 and 1991, they determined that both early initiation of prenatal care and the adequacy of prenatal care increased substantially among women most likely to have been affected by expanded Medicaid coverage - younger, less-educated women from low-income neighborhoods. Using older, better-educated women from higher-income neighborhoods as a natural control group, they found no differences in the likelihoods of either premature delivery or a very low birthweight (less than 1,500 grams) delivery. Epstein and Newhouse (1998) examined Medicaid expansions in the mid-1990s in California and South Carolina, and found similar results. Looking at low-income women before and after the expansions, they found increases in the timely initiation of prenatal care, but no differences in the incidence of either premature or low birthweight (less than 2,500 grams) births.

B.2. Birthweight

Rosenzweig and Schultz (1983a) used data from the 1967-69 National Natality Followback Surveys to estimate the relationship between delay in initiating prenatal care and low birthweight. After adjusting for unobserved factors that might affect both poor birth outcome and the initiation of prenatal care, they found that women who delayed care were significantly more likely to have a low birthweight baby or a baby who died. In a similar study using New York City data for 1984, Grossman and Joyce (1990) also found that after adjusting for potential endogeneity bias, prenatal care delay increased the risk of low birthweight, although the association was not statistically significant for whites. A delay of one month in initiating prenatal care reduced birthweight by 23 grams (0.7%) for whites and 37 grams (1.2%) for African-Americans.

Liu (1998) applied a similar statistical strategy, controlling for potential selection bias in both pregnancy resolution and initiation of prenatal care, to estimating separate models of birthweight by race and urban/rural residence for Virginia births in 1984. He found that prenatal care delay had a small negative impact (an average of 14 grams per month of delay) on birthweight when a standard statistical method was applied to the observational data. Adjusting for possible selection bias by using an instrumental variable regression method increased the magnitude of this effect over fivefold on average: birthweight was roughly 76 grams lower per month of delay.

Hanratty (1996) analyzed the impact of insurance expansion on birth outcomes using data from a natural experiment, the gradual implementation across provinces of Canadian national health insurance between 1962 and 1972. Using a times-series cross-section statistical design applied to all Canadian births between 1960 and 1975, she found

that the provincial introduction of national health insurance was associated with statistically significant declines of 1.3-2.7% in the incidence of low birthweight. She also cites other evidence (McDonald et al. 1974) showing significant increases in the early use of prenatal care, suggesting that this may have been one of the mechanisms leading to improved birth outcomes.

In contrast to these studies, Meara (2001) found no evidence that differences in prenatal care or insurance coverage explained differences in birthweight between low-education and high-education mothers. Rather, most of the difference was explained by differences in mothers' health habits and health knowledge. More generally, Fiscella (1995) reviewed studies (other than those cited above) of the relationship between prenatal care and birth outcomes, and failed to find conclusive evidence that more or better prenatal care significantly improved birth outcomes.

Turning to the studies of the effects of the Medicaid expansions on birthweight, Cole (1994) analyzed state level data from 1983 through 1990 when Medicaid was expanding eligibility to low-income women. Increased Medicaid eligibility reduced rates of low birthweight (and prematurity) for white women and black teenagers, but the effects were very small after controlling for other factors. Long and Marquis (1998) linked vital statistics and Medicaid eligibility records from Florida for 56,101 women who gave birth in 1988-89 and 78,421 women in 1991. Using a difference-in-the-differences approach, women covered by Medicaid had a substantially greater decrease in the rate of low-birthweight births, 6.1 per 1,000 births, compared to a decrease of 0.7 per 1,000 births for women with private insurance. However, Kaestner (1999) failed to find any significant relationship between insurance status and either average birthweight or

low birthweight in an analysis of individual births by race from the 1988 National Maternal and Infant Health Survey.

In other before-and-after studies, Haas, Udvarhelyi, and Epstein (1993) and Haas, Udvarhelyi, Morris, and Epstein (1993), who analyzed birth outcomes in Massachusetts in 1984 and 1987, failed to find any significant effects of the Massachusetts Healthy Start Program, which expanded coverage of low-income pregnant women from 100 to 185% of poverty in 1985, on several measures of birth and maternal outcomes. Since studies limited to a single state may be affected by unique events or characteristics of those states, Dubay et al. (2001) analyzed a large national sample of birth certificates from 1980, 1986, and 1983. They compared changes over time in the percentages of women with late initiation of prenatal care and the percentages of low weight births (less than 2,500 grams). The comparisons are made between subsets of women (grouped by marital status and years of education) more likely to have been affected by the expansions of Medicaid eligibility and women less likely to have been affected. They found that there were significant improvements in prenatal care initiation by the groups more likely to have been affected by the expansions, but they failed to find any differences in birthweight outcomes. Currie and Grogger (2000) came to a similar conclusion in their analysis of the effects of increasing Medicaid income eligibility ceilings and expanding welfare rates on the adequacy of prenatal care and birthweight from a national sample of birth certificates from 1980-1990. Like Dubay et al. (2001), they found improvements in prenatal care but no impact on birthweight. Studies of the associations between medical care use and insurance coverage, and gestation and birthweight are summarized in Table 6.

B.3. Survival

In one of the first studies of the association between medical care availability, Medicaid policy, and neonatal mortality rates across U.S. counties in the period 1964-1977, Grossman and Jacobowitz (1981) found little evidence that either factor contributed to the substantial decline in neonatal mortality rates over this period. However, their measures of both medical care availability (physicians per 1,000 population in the county) and Medicaid policy (various indicators of whether Medicaid covered first-time pregnancies) were both very crude. Moreover, medical care availability was not treated as a potentially endogenous variable. In a later analysis of essentially the same county data, Corman, Joyce and Grossman (1987) used more direct measures of "inputs" into the "production" of infant health, prenatal care (percentage of births with care initiated in the first trimester) and the availability of neonatal intensive care units, and treated both as potentially jointly determined (endogenous) with neonatal mortality rates. Using an instrumental variable method to estimate separate models for Whites and African-Americans, they found a statistically significant and negative association between neonatal mortality rates and for both prenatal care and neonatal intensive care units. (Statistical significance varied with whether low birthweight was included in the model and by race.)

In related analyses, Corman and Grossman (1985) also found a significant negative association between the availability of neonatal intensive care in a county and neonatal mortality rates across counties over the years 1969 to 1977. They found little evidence that Medicaid coverage of first-time pregnancies influenced Whites' neonatal

mortality rates. The significance of neonatal intensive care unit (NICU) availability was reinforced by another study that was able to estimate separate models of neonatal mortality for low and normal birthweight babies (Corman, Grossman and Joyce 1988). As one would expect, the association between NICU availability and neonatal mortality was stronger for low-weight than for normal-weight births. However, it was statistically significant only for Whites and not for African-Americans. However, in a cross-sectional analysis of neonatal mortality rates across large counties in 1977 that employed instrumental variable estimates of neonatal intensive care availability and timely initiation of prenatal care, Joyce, Corman and Grossman (1988) found statistically significant and negative associations with both Whites' and African-Americans' neonatal mortality rates.

Rosenzweig and Schultz (1983b) again used data from the 1967-1969 National Natality Followback Surveys to investigate the relationship between household choices about prenatal care and infant mortality. They found that using an instrumental variable estimate for prenatal care delay resulted in a statistically significant and positive effect on infant mortality, i.e., longer delay was associated with higher infant mortality. (Estimating their model with observed prenatal care delay implied no association between delay and infant mortality.)

Other studies have related broader measures of medical care use to various measures of infant mortality. Hadley (1982) used variations in Medicare spending per beneficiary to construct an instrumental variable estimate of the relationship between per capita medical spending across U.S. county groups in 1970 to race-gender-specific infant mortality. He found that a 10% higher level of spending was associated with a 1.5-2.0%

lower infant mortality rate. The study by Hanratty (1996) of the effect of implementation of national health insurance in Canada estimated a four percent decrease in the infant mortality rate associated with full implementation of the program.

Cremieux, Ouellette, and Pilon (1999) also used Canadian data to estimate the association between per capita spending and gender-specific infant mortality for Canadian provinces over the time period 1978-1992. While they did not use an instrumental variable method, they did have the advantages of much more precise data on health care spending and population characteristics, as well as controls for province-specific and time-trend effects. Their statistical model also included the number of physicians per capita as an independent variable. They found that both per capita spending and physician availability had negative and statistically significant effects on infant mortality rates, with a 10% higher level of spending associated with a 0.4-0.5% lower infant mortality rate.

In other research relating insurance coverage to infant survival (and other measures of infant health), Braveman et al. (1989) compared adverse outcomes (prolonged hospital stay, transfer to another hospital, or death) for uninsured and privately insured newborns in California between 1982 and 1986. They found that the percentage of newborns without insurance increased over time, and that by 1986 uninsured newborns were 1.31 times more likely to have an adverse outcome. These risks were especially high among Blacks and Latinos. Moss and Carver (1998) examined neonatal and post-neonatal infant mortality from survey data that provided extensive controls for birthweight and mothers' health behavior. Uninsured babies had 1.4-1.5 greater odds of both neonatal and post-neonatal death, compared to the privately insured.

Currie and Gruber (1996a) treated the annual variations across states and over time (from 1984 to 1992) in Medicaid expansions of eligibility to pregnant women and children as a natural experiment and used a time-series, cross-section analysis of state data to identify the effects of expanded Medicaid eligibility. Unlike Dubay et al. (2001), who analyzed changes in birthweight rather than infant or neonatal mortality over roughly the same period, they found that the more than three-fold increase in potential eligibility (from 12.4 to 43.3% of 15-44-year-old women) reduced infant mortality by 8.5 percent.

In a study that addressed the question of whether longer post-partum stays for infants affect their health, Malkin, Broder and Keeler (2001) analyzed data from over 108,000 births in Washington state in 1989 and 1990. Infant health was measured by the probability of being readmitted to a hospital between 14 and 60 days, which occurred for between 2.0-5.0% of the births in their data. Using instrumental variable analysis to adjust for the fact that the infant's health affects post-partum length of stay, they estimated that a 12-hour increase in post-partum length of stay would reduce the probability of readmission by 0.6 percentage points. This study is pertinent because they used infants' insurance coverage to create their instrumental variable for length of stay, and found that Medicaid infants stayed four hours less and uninsured infants stayed six hours less than privately insured infants, controlling for an extensive set of infants' health characteristics.

Finally, recalling the findings that uninsured women, and to a lesser extent women covered by Medicaid are less likely to have C-section deliveries, even in high-risk situations, Lee et al. (1998) analyzed 371,692 singleton live births with breech

presentation in the U.S. between 1989-1991. C-section deliveries had lower neonatal mortality rates compared to vaginal deliveries for all birthweights, e.g., for babies weighing 2500g or more, C-section deliveries had a significantly lower ($p < .001$) neonatal mortality rate of 3.2 per 1000 births compared to 5.3 per 1000 vaginal deliveries.

Overall, these studies suggest that early initiation of prenatal care may not in and of itself have a significant and strong effect on birth outcomes (gestation/prematurity, low birthweight and survival). However, access to (or delivery in) hospitals with NICUs and greater medical care spending appear to be more strongly associated with better birth outcomes (higher birthweight and greater survival). As in the research on adults' general health outcomes, several of the studies demonstrated the importance of using statistical methods to adjust for possible bias due to reverse causation or unobserved differences in underlying health and other characteristics across mothers. The studies of infant survival are summarized in Table 7.

This general conclusion is consistent with the analysis performed by Cutler and Meara (1999), who asked whether the value of increased life expectancy for low-birthweight infants has been worth the cost of the investment in expensive birth-related medical care. Using annual data from 1950 through 1995, they estimated that increased spending for the care of low-birthweight infants, roughly $39,000 more per birth in 1990 than in 1960, resulted in the survival of an additional 12% of low-birthweight infants, "…at what will likely be a reasonable — if not disability free — life." In their analysis, they cite research suggesting that most of the improvement was due to medical care in the immediate post-birth period (Paneth et al., 1995; Williams and Chen, 1982). Using

relatively conservative estimates of the value of an additional year of life, they conclude that the benefits have substantially exceeded the costs. Cutler and Meara (2001) present further evidence suggesting that most of the reduction in infant mortality over the second half of the 20th century was due to reductions in neonatal mortality (within the first 28 days of life), which can be attributed to substantial medical improvements in the care of low birthweight and premature infants, rather than to significant gains in birthweight or gestation. Thus, insurance coverage will influence infant survival to the extent that it affects access to these advanced and costly neonatal care medical services.

C. Child and Maternal Health Outcomes

Currie and Gruber (1996b) also analyzed the effects of expanded Medicaid eligibility from 1984 through 1992 for children, and found that the nearly twofold increase in eligibility (from 16.1 to 31.2% of children) reduced childhood (ages 1-14) mortality by roughly five percent. Both studies by Currie and Gruber (1996a, 1996b) have been criticized because their state-level analyses focused on eligibility expansions across states and over time, rather than on pregnant women and children who actually shifted from uninsured to Medicaid coverage. Kaestner et al. (1999) argued that the estimated reduction in childhood mortality rates was implausibly large compared to the actual expansion in coverage and, therefore, may be biased upwards. They also point out that the portion of the Currie and Gruber (1996b) study that analyzed individual data on children's health status (as opposed to state-level data on childhood mortality) did not detect significant improvements in health status.

In their study, Kaestner et al. (1999) analyzed individual data and attempted to correct for selection into Medicaid coverage. They found only weak evidence that white children with private insurance and nonwhite children covered by Medicaid are more likely to be in good or excellent health compared to uninsured children. Racine et al. (2001) also analyzed individual data on children between the ages of 1 and 12 from the National health Interview Surveys for 1989 and 1995. Using a difference-in-differences approach to control for unobserved confounding factors, they conclude that the Medicaid expansions reduced uninsurance among low income children, but had minimal effect on either health services use or health status.

Several studies have assessed the effects on children's health of enrolling in expanded state health insurance programs for low income children. Holl et al. (2000) evaluated changes in health for a sample of 1,730 children who enrolled in CHPlus in western New York between 1991 and 1993. Twenty-five percent of parents reported improvements in their child's health as a result of CHPlus enrollment. Lave et al. (1998) compared the health after 12 months of 1,031 children who enrolled in BlueCHIP in western Pennsylvania in 1995 to the health at baseline of a control group of 460 similar children who were newly enrolled in the program. They found a more than three-fold difference (57% compared to 16%) between the treatment group after one year and the newly-enrolled comparison group in the proportion of children with unmet health needs. Similar findings were reported by Feinberg et al. (2002) for children enrolled in Massachusetts' SCHIP program.

Keane et al. (1999) reported significant reductions in the proportion of children in BlueCHIP whose activities were restricted by their parents because of concerns over the lack of health insurance. This effect increased with the age of the child, with the proportion with activity restrictions falling from 15.4% of 11-14 year olds and 18.5% of 15-18 year olds to nearly 0. Concerns about lack of insurance and activity restrictions my not be unfounded, since Tilford et al. (2001) reported that self-pay children had the highest observed mortality in a study of 477 children who presented with head trauma at three pediatric intensive care units in 1996. Insurance status was not statistically significant in multivariate analysis controlling for admission severity, which may have been related to unobserved insurance-related differences in delays in seeking care.

Relatively few studies have analyzed the relationship between insurance coverage and mothers' health. Haas and McCormick (1997) conducted a five-year follow-up analysis of the health of a sample of 985 women who had given birth to a premature or low birthweight infant in 1985. They found that having one or more years of insurance coverage, whether Medicaid or private, significantly reduced the odds of being in fair or poor health at follow-up (0R = 0.26 for >1 year of Medicaid and 0.42 for > 1 year of private insurance). Haas, Udvarhelyi and Epstein (1993) did not find any evidence that the Mass Healthy Start Program aimed at pregnant women had any effect on women's health between 1984 and 1987. However, they did find that uninsured women at baseline had a significantly higher rate of adverse maternal outcomes (5.5% vs 5.1%). Table 7 summarizes the studies of child and maternal health outcomes.

CHAPTER 7 - A CLOSER LOOK AT MEDICAID

Many of the studies of both disease-specific and general health outcomes discussed in previous chapters have reported worse outcomes for people covered by Medicaid compared to those with private insurance, and sometimes outcomes that are no better than those of the uninsured (Bluestein, Arons, and Shea, 1995; Braveman et al., 1993; Braveman et al., 1994; Canto et al., 2000). Several of the evaluations of the effects of the expansions of Medicaid eligibility to more low-income women and children in the late 1980s and 1990s failed to find positive effects on health outcomes. Do these results imply that having Medicaid causes poor health or that health insurance has no effect on health? What might explain these apparently incongruous findings?

One possible explanation, consistent with the general problem of the endogeneity of health insurance coverage and health, is that people covered by Medicaid, who voluntarily choose to enroll in the program, are systematically different from both the general population of uninsured people as well as the population of privately insured. By design, people covered by Medicaid, through much of the time periods covered by these studies, tended to have the lowest incomes and education levels, were members of single-parent families, and were not in the labor force. For the most socially and financially disadvantaged people, health insurance alone may not be sufficient to overcome barriers to the timely and efficient use of medical care created by poor education, unstable family and living arrangements, and very low income.

In contrast, many of the uninsured are either low-income workers or their dependents, and are more likely to be part of two-parent households. As an example of the effects of potentially significant differences in the characteristics of people covered

by Medicaid, Krug et al. (1997) in a study of 4,318 admissions of children through the emergency department, found that children on Medicaid were more than twice as likely as either uninsured or privately insured children to be admitted for "nonmedical" reasons, i.e., for reasons having to do with the child's social-economic situation rather than clinical condition.

Moreover, since people voluntarily choose to enroll, those who seek Medicaid coverage may be in poorer health to begin with or may anticipate medical problems. It is estimated that between 40-50% of nonelderly adults covered by Medicaid obtain their coverage for reasons not related to income or welfare status.[5] In other words, they are most likely eligible because of poor health, either disability or a major health expenditure that causes income to fall below the ceiling for coverage through medical spend-down provisions. This phenomenon creates a form of selection bias that distorts the true effect of extending insurance coverage to an uninsured population.

A second possible explanation for the weak results associated with Medicaid is that the structure of Medicaid itself varies dramatically from state to state, in ways that are very difficult to control for statistically. While Medicaid provides medical care at no cost to the recipient, the amount, quality, and timeliness of that care can vary widely because of substantial differences in how much Medicaid pays providers and their willingness to treat Medicaid beneficiaries. In some locations, care paid for by Medicaid may not be very different from or better quality than care provided at no cost to the uninsured in public clinics and hospitals, or that the uninsured pay for themselves. For example, Currie, Gruber, and Fischer (1995) found evidence that over the period 1980-

[5] Derived from calculations using CMS 2082 data on Medicaid enrollment in 1998. Personal communication from Brian Bruen, March 27, 2002.

1992, variations across states in the ratio of Medicaid to private fees for obstetricians-gynecologists were significantly related to infant mortality rates. They estimated that a ten percent higher average Medicaid fee was associated with a 0.5-0.9 percent lower infant mortality rate. Gray (2001) investigated the same relationship (between Medicaid fees and birth outcome) using data from the 1988 National Maternal and Infant Health Survey. Using a difference-in-differences approach to control for the effects of unobservable factors, he concluded that higher Medicaid fees were significantly related to a lower risk of having a low birthweight infant. Thus, unmeasured differences in the structure and generosity of particular Medicaid programs make it difficult to attribute differences in health outcomes between people covered by Medicaid and private insurance to a simple measure of having a particular type of insurance coverage.

A third problem faced by many of the studies of Medicaid effects on health is that it is often difficult to determine exactly when Medicaid coverage began. For example, many pregnant women or low-income sick people may not have been enrolled in Medicaid until their conditions were sufficiently advanced to warrant a visit to a hospital. Although their sample was small (n=149), Oberg et al. (1990) found that 28% of the women who were uninsured at the start of their pregnancy were covered by Medicaid at the end of pregnancy. Katz et al. (1994) in an analysis of Medicaid-covered women who had babies in Washington state in 1988-89 found that 28% enrolled in the third trimester and 19% enrolled in the second trimester. Women who enrolled in the third trimester were 6.3 times more likely than privately insured women to have had inadequate prenatal care.

Once contact with a provider has been made, it is in the provider's interest to seek Medicaid coverage ex-post in order to obtain reimbursement for services that would otherwise be written off as charity care or bad debt. Thus, at the time care is sought or obtained, people, who later identify themselves or appear as Medicaid recipients on survey or administrative data, are in fact more similar to uninsured people than they are to people with continuous private insurance coverage. Similarly, Medicaid coverage is often short-term or transitory, while the positive health effects of increased medical care use by a population due to expanded insurance coverage may take several years to reveal themselves.

Finally, most of the pre/post-Medicaid expansion studies have been unable to identify and analyze the specific people who shifted from uninsurance to Medicaid. Research suggests that 15-50% of people who enrolled in Medicaid in response to the expansions may have switched from private insurance (Shore-Sheppard 2000). Szilagyi et al. (2000) reported that 38% were fully insured, 27% were uninsured for 1-5 months, and 35% were uninsured 6-12 months. These types of shifts would tend to bias results toward a finding of no difference by insurance status. In fact, Currie and Gruber (2000), who analyzed medical care received at childbirth, found that women who probably shifted from private insurance to Medicaid coverage were likely to have experienced a reduction in childbirth-related procedures.

Another form of substitution, reported by Epstein and Newhouse (1998), was California's reduction in funding for public clinics that accompanied its expansion of Medicaid coverage for pregnant women. Uninsured pregnant women who may have received free care from public clinics prior to the expansions may have received the same

care, now paid for by Medicaid, after the expansions. This may be one factor explaining why other studies (Haas et al. 1993; Piper, Ray and Griffen 1990; Dubay et al. 1995; Braveman et al. 1993) have failed to find increases in prenatal care use that accompanied expansions of Medicaid coverage, or differences in service use associated with Medicaid coverage of children (Racine et al. 2001; Kulthau et al. 2001).

Given that a number of studies have found that people insured by Medicaid have worse health outcomes than the privately insured, it seems plausible to conclude that extending health insurance coverage to the currently uninsured would result in little, if any, health benefit. Taking a closer look at Medicaid — at the characteristics of people covered by Medicaid, at differences across Medicaid programs and between Medicaid and private insurance, at possible substitutions between Medicaid and either private insurance or free medical care from the safety net, and at the statistical treatment of Medicaid coverage in the great majority of observational studies — suggests a number of explanations for the apparently paradoxical findings of many of these studies. The extent to which these explanations are valid limits the validity of drawing conclusions from these studies to the effects of extending health insurance to the currently uninsured. If anything, they highlight the potential inadequacies of Medicaid, in both its structure as an insurance program and as the sole mechanism for addressing the health problems of the most disadvantaged Americans.

CHAPTER 8 - INSURANCE STATUS AND MEDICAL CARE EFFICIENCY

If the uninsured have poorer access to timely medical care than the privately insured, then are the uninsured also more likely than the privately insured to be hospitalized for conditions that could have been treated on an ambulatory basis? What share of the uninsureds' hospital stays could have been avoided, and what is the cost of those extra hospitalizations?

One might also hypothesize that the uninsured have longer hospital stays and require more procedures because of their poorer access to preventive and ambulatory care services. However, as noted above, research generally suggests that the uninsured have shorter stays and are less likely to receive needed services, and that the lack of care when admitted is one of the factors that leads to adverse health outcomes. In other words, the uninsured do not necessarily receive compensatory care once admitted to the hospital. (One exception is Weissman et al. (1991) who found that uninsured people were more likely to delay seeking hospital care, but once admitted, their stays were nine percent longer, controlling for other factors.)

In one of the most comprehensive analyses of preventable hospitalizations, Hoffman and Gaskin (2001) compared rates of preventable hospitalizations for uninsured and privately insured people using hospital discharge data from nine states in 1996. Uninsured adults were from 33 to 82% more likely to be admitted for a preventable condition than insured adults, depending on the state. Overall, 12.3% of the uninsureds' hospital stays were for preventable conditions, compared to 8.4% of the privately insureds' hospital stays. Adjusting for case mix differences, the average cost

per preventable hospital stay in 2002 by the uninsured was $3,300 for adults, which amounted to more than $105 million in the nine states.

Other studies that have tabulated differential rates of preventable hospitalizations have found similar results. Kozak, Hall, and Owings (2001) measured rates of preventable hospitalizations using National Hospital Discharge Survey data for 1980, 1990, and 1998. The 1998 rates were 11.6% for the uninsured and 7.5% for the privately insured. Both rates have increased substantially since 1980, when they were 5.1% and 4.1%, respectively, and the difference between them widened. Pappas et al. (1997), who also analyzed the 1990 National Hospital Discharge Survey, estimated somewhat different rates because of differences in definitions of preventable hospitalizations: 13% of the uninsureds' stays were for preventable conditions, compared to 10% of stays for the privately insured. A study of hospital discharge data in Massachusetts and Maryland for 1987 found that among non-elderly adults, the uninsured were from 29 to 76 percent more likely to be hospitalized for an avoidable condition, depending on age and gender, compared to the privately insured (Weismann, Gatsonis, and Epstein 1992). Billings and Teicholz (1989) found that 39% of the uninsureds' hospital admissions in the District of Columbia in 1988 were for avoidable conditions, compared to 21% for Medicaid admissions and 12% for privately insured admissions.

Two studies of the Medicaid expansions of the late 1980s also found evidence that having insurance improves the efficiency of medical care use. Dafny and Gruber (2000) analyzed National Hospital Discharge Survey data for the years 1983 through 1996 to assess whether the rate of avoidable hospitalizations for children across states and over time was related to the expansion of Medicaid eligibility for children that

occurred beginning in the late 1980s. The analysis found that each percentage point increase in Medicaid eligibility significantly reduced the rate of avoidable hospitalizations by 0.034 percentage points. Over this time period, Medicaid eligibility increased by about 16 percentage points, which is estimated to have reduced children's rate of avoidable hospitalizations by 22%. Their analysis also showed that overall hospital use increased because of the Medicaid expansions and also shifted out of public hospitals. (Greater hospital use may partially explain the finding reported above by Currie and Gruber (1996b) of a decrease in childhood mortality associated with expanded Medicaid eligibility. Currie and Gruber (1996b) also reported that expanding Medicaid eligibility reduced the odds that a child would not have a doctor visit in the last year, which also suggests a possible mechanism underlying the association between expanded eligibility and reduced avoidable hospitalizations.) Another analysis of approximately the same time period, but using a different data set and approach, also found that the hospitalization rate for preventable conditions declined more in states that had greater expansions of Medicaid eligibility (Kaestner, Joyce, and Racine, 1999).

Another dimension of inefficient resource use is the tendency for low income people to use the emergency room for nonurgent ambulatory care that could be provided at lower cost in physicians' offices or ambulatory care clinics. Baker and Baker (1994) analyzed whether costs differ using data from the 1987 NMES on charges for care in emergency departments and other settings for people with particular health conditions that are not usually associated with urgent care. Controlling for a number of patient characteristics, they found that on average, the emergency department charge was almost 2.9 times higher than the charge for an initial visit in another ambulatory care setting

(physician's office or clinic), or about $94 per visit in 1987 dollars. (For a more restricted sample of less severe cases, the absolute differences were about $65, although the relative difference remained at 2.9.) Another study of the cost of emergency department care (Williams 1996) found that the marginal cost of a visit was much less than the average cost of a visit, based on all emergency department visits to six Michigan hospitals—$88 compared to an average cost of $209, which was 42% of the average charge. However, even if the marginal cost is less than the average cost in the emergency department, this relationship would also apply in physicians' offices and clinics. Thus the difference in marginal costs between emergency departments and other settings may still be substantial.

Are the uninsured more likely to use the emergency room for nonurgent care? According to research by Cunningham et al. (1995), the answer is "No." Using data from the 1987 NMES, they estimated a multivariate regression model of using the ER for nonurgent care. Controlling for health, income, and several other socio-demographic factors, there was no difference between the uninsured and the privately insured in the likelihood of a nonurgent ER visit. Among the nonelderly, only those with Medicaid or other public insurance were significantly more likely to have had a nonurgent ER visit. The authors believe that these results reflect public insurance programs' low fees for care provided private physicians, which reduces their willingness to treat publicly insured people. In addition, the uninsured may be better able to afford care from other settings because they typically have higher incomes than the publicly insured, and the uninsured probably prefer to seek care from other settings because of ER's higher prices, for which

they would be fully liable. Halfon et al. (1996) also reported that insurance status was not related to routine ER use by children, based on analysis of data from the 1988 NHIS.

CHAPTER 9 - HEALTH AND ANNUAL INCOME (WORK AND/OR WAGE RATES)

If one accepts that lack of health insurance reduces health status, then what are the consequences for work and annual income? Studies have looked at various components of work effort—labor force participation, amount of work (hours per week), wage rates, and annual income. Although results vary, in part due to variations in how health is measured, the research generally concludes that poor health reduces annual earnings from work, primarily through reduced labor force participation and work effort in conjunction with a small effect on productivity, as measured by wage rates. (Much of the information reported here and in the next section is from an extensive and detailed critical review of the effects of health on work and education by Currie and Madrian (2000).)

The studies summarized below focus primarily on the relationship between health and annual income, which is essentially the product of hours of work (labor force participation and work effort) and income per hour (productivity). A recent report from the National Academy on an Aging Society (October 2000) presented data from national surveys conducted in the early 1990s on health and income characteristics of early retirees (ages 51-59) and older workers (60 and older). Among the 51-59 year old cohort, a much higher proportion of early retirees reported that they were in fair/poor health, 46% compared to 12% of workers of the same age. However, among older people, a much higher proportion of workers report themselves to be in excellent or very good health, 48% compared to 26% of nonworkers. Moreover, young retirees in fair/poor health report substantially lower median incomes ($15,000 compared to $41,000) and median wealth ($34,000 compared to $200,000) than young retirees in excellent or very

good health. Thus, high income and wealth appear to induce healthy people in this age group to retire early, but, simultaneously, poor health in this same age group reduces both income/wealth and forces early retirement.

These simple tabulations illustrate the complex relationships among health, work, and income. Poor health appears to reduce work and income, as long as the effects of high income and wealth on the early retirement of the healthy do not dominate. More sophisticated analyses of labor force transitions for older workers (age 50 and above) confirm the effects of both poor current health and health deteriorations over time (Bound et al., 1999; Blau, Gilleskie and Slusher 1999). Controlling for prior health, poor current health is strongly associated with both labor force exit in general and application for disability insurance benefits.

As straightforward as these inferences may appear, studies of the relationship between health and work and annual income can be confounded by two problems. The first is that people who choose not to work or to work less may be motivated to report poor health in order to qualify for health-related income payments (disability income or SSI, for example), or because "poor health" is a socially acceptable reason for not working. Second, if people in poor health are less likely to work, estimating the relationship between health and earnings (or wage rates) from data on workers probably understates the total effect of health, since the working population is a selected sample based in part on the effect of health on labor force participation.

Given these difficulties, two studies of men with arthritis (Mitchell and Burkhauser, 1990; Mitchell and Butler, 1986) and one study that used a measure of general health over an extended time period (Chirikos and Nestel, 1985) were able to

adjust for the potential selection bias associated with labor force participation. These studies generally found that poor health (having arthritis or poor general health) reduced annual earnings by 15-30 percent.

Three other studies did not make the econometric corrections, but still found significant negative effects of poor health on annual earnings. Luft (1975) found that people with activity limitations had annual earnings 30-40% lower than people without limitations. Bartel and Taubman (1975) estimated that earnings were 8.5 percent lower for people with heart disease or hypertension, 22.4% lower for people with arthritis, and 28.7% lower for people with bronchitis or asthma. Finally, Mullahy and Sindelar (1993), who analyzed survey data collected in New Haven, Connecticut, found that people in good physical health had annual earnings 37.7% higher than people with health problems.

Several studies have focused on the effects of mental illness, alcoholism, and drug addiction (Bartel and Taubman, 1986; Ettner et al., 1997; Mullahy and Sindelar, 1993 and 1995). Although the effects of health insurance on health status related to these conditions are not well established, these studies also find significant negative effects on income associated with neuroses, psychoses, and both recent and long-term alcoholism. The size of the estimates ranges from –10% to –47%.

Most recently, Fronstin and Holtmann (2000), who did not adjust for possible bias due to the effect of poor health on labor force participation, estimated that workers in good health earned 13.3-20.5% more than workers in poor health, depending on the industry and the size of their employer. In work in progress, Hadley and Reschovsky (2001) estimated the effect of health status on hourly wage using a Heckman selection model to adjust for bias due to the effect of health on labor force participation. Estimated

with data on non-elderly adults from two large nationally representative surveys conducted in 1996 and 1998, the results suggest strong negative effects of fair or poor health status on both labor force participation and hourly wages. Those in poor health were less than half as likely to work and, if they did work, their hourly wage was about 23% lower.

There is also evidence that poor health of a family member reduces the caregiver's work and earnings. Wolfe and Hill (1995) found that single mothers are less likely to work if they have a child with a disability. This same study estimated that providing health insurance for children not tied to AFDC/Medicaid prohibitions against work would increase single mothers' labor force participation. Similarly, several studies (Ettner, 1995a, b; Boaz and Muller, 1992; Stern, 1996a) have found that women are more likely to work less or not at all if they have a disabled or very ill parent, with one study (Stern, 1996a) estimating an approximately 20 percent reduction in labor force participation. Berger (1983) studied the effects of a spouse's illness, disability, or death on labor supply and found that both husbands and wives are affected, but in opposite direction, with husbands decreasing labor supply in response to a wife's health decline, and wives increasing their labor supply in response to a husband's health decline. Muurinen (1986) analyzed data on 1,445 family caregivers from the National Hospice Study. Just under half were in the labor force with annual incomes of approximately $17,000 at the onset of informal caregiving for a dying person. About 30% left the labor force and almost all of the others reduced their hours worked. The probability of leaving the labor force was inversely related to the caregiver's annual earnings.

Overall, these studies suggest that "fair or poor" health, due to either a disability, a serious chronic condition, or general self-assessment, is associated with a 15-20 percent reduction in annual earnings. Most of the reduction appears to come from lower labor force participation and work effort.

CHAPTER 10 - HEALTH AND EDUCATIONAL ATTAINMENT

The relationship between health and education represents a potential link to future earnings. If poor health in children adversely affects their educational attainment, both in terms of total quantity of education and level of achievement, then future earnings will be adversely affected because of the relatively strong association between education and earnings.

There are fewer recent studies in this area than in the others examined. However, the research does seem to support the existence of a negative effect of poor health on educational attainment. Quoting Currie and Madrian (2000), who provide a thorough summary, "Many authors (Grossman, 1975; Perri, 1984; Wolfe, 1985; Wadsworth, 1986) have noted that poor health in childhood is associated with reduced educational attainment. In turn, individuals with less schooling receive lower wages and have weaker labor force participation. Reduced educational attainment may also have a causal effect on adult health…(Grossman and Kaestner, 1997)."

Several studies have also found a relationship between poor child health (low birth weight, stunted growth) and cognitive development, which also affects educational attainment (Broman et al., 1975; Edwards and Grossman, 1979; Shakotko et al., 1981; Chaikind and Corman, 1991; Rosenzweig and Wolpin, 1994; Buck et al. 2000; Hack et al 2002). One of the most recent studies relevant to this question followed a cohort of 3,000 people born in Britain in 1946 up to age 43 (Richards et al., 2001). Comparing various measures of cognitive function through age 26, the analysis found that low-birthweight people had significantly lower scores than normal-birthweight people. A difference still existed at age 43, but it was smaller and not statistically significant.

In general, this literature is much harder to convert to quantitative estimates along the lines of "Poor health reduces educational attainment by X%." For example, Wolfe (1985) used data from a child health survey conducted in Rochester, New York over several years in the early 1970s to estimate a jointly causal model in which school attendance and achievement scores influence each other, with alternative measures of chronic health affecting both attendance and achievement. The estimates indicate that both days absent from school and achievement level are significant determinants of each other, i.e., lower achievement levels cause greater school absence, and greater school absence lowers achievement. The results also suggest that children who have problems with strenuous activities or health problems "likely to interfere with school interactions" have 3.8 and 1.8 more school days absent per quarter than children without such problems, and that children with "moderate to severe psychological discomfort" have lower school achievement. Thus, depending on its particular manifestation, chronic health conditions lower achievement both directly and indirectly through their effects on school attendance.

Research by Edwards and Grossman (1979) and Shakotko, Edwards, and Grossman (1980) used data from cycles II and III of the Health Examination Surveys conducted in 1963-65 and 1966-70. Approximately 7,000 children were surveyed in each cycle (6-11 year olds in cycle II and 7-12 year olds in cycle III). Although difficult to summarize because of the variety of health measures used, the first study concluded that both current health and health in infancy are significantly related to intellectual development. They estimated that a child weighing less than 2,000 grams at birth has

lower IQ and lower school achievement of between one-quarter and one-half standard deviations in the test scores compared to a normal birthweight child.

The second study estimated the joint relationships between health and cognitive development, as well as the role of parents' health. It found that health and cognitive development significantly affect each other, i.e., better health leads to better cognitive development, and higher cognitive development has a positive effect on health. Mother's education is also a very significant factor, suggesting that over time, improved health in childhood can improve the child's own cognitive achievement and the health of future children.

In one of the few studies to attach any type of cost estimate to poor health in children, Chaikind and Corman (1991) analyzed data on 8,000 children between the ages of 6 and 15 from the 1988 HIS Child Health Supplement. 7.5% of the sample had been low birthweight (less than 2,500 grams). These children were 50% more likely to receive some type of special education, at an estimated national cost of $371 million annually.

Finally, Case, Lubotsky, and Paxson (2001) explored the relationship between family income and childhood health using several large national data sets, both cross-sectional and longitudinal, over several years (1988 through 1997). As noted above, one of the major challenges faced by the research on the relationship between income and health is identifying and measuring whether poor health causes low income, low income causes poor health, or both. This analysis largely eliminates one direction of causation, since children's health should not have a large impact on parents' expected incomes, although observed income may be influenced by parents' labor force participation decisions. They found that children's health is significantly poorer in lower income

households. While they cannot identify the specific mechanisms (such as higher quality or more timely medical care, better nutrition, safer home environment) that lead to this relationship, they do find that "…children from poorer households enter adulthood in poorer general health, with more serious chronic conditions, and having missed more days of school - all of which may compromise their future earnings ability." In other words, poor health in childhood appears to reinforce poorer health and lower income in adults, which in turn limits adults' access to health insurance and further contributes to the intergenerational transmission of poor health and low investment in human capital.

Collectively, these studies generally support the conclusion that improving children's health will lead to greater educational attainment and subsequent better health and higher income as adults. However, the studies also suggest that prematurity and low birthweight lead to higher medical and education costs during childhood. To the extent that premature birth or low birthweight are less amenable to medical interventions than infant survival, then advances in infant survival may increase future health care and educational costs.

CHAPTER 11 - SUMMARY AND IMPLICATIONS

This review shows that there is a substantial body of research consistent with a model postulating positive relationships between health insurance, use of medical care, health, income, and education. However, as noted at the outset, none of these studies is definitive, nor are their findings universal. The literature also includes studies that have failed to find a positive relationship between good health and having health insurance or using more medical care.

While all of these studies suffer from methodological flaws of varying degrees, two general observations appear warranted. The first is the fairly remarkable degree of consistency across the studies that support the underlying conceptual model of the relationship between health insurance and health. Studies of different medical conditions, conducted at different times, using different data sets and statistical methods have produced quantitative estimates of the effects of having health insurance or using more medical care that are both consistent with each other and fall within a relatively narrow range. (See Table 9, which summarizes selected studies from each of the different areas of research presented in the preceding chapters.) This degree of quantitative agreement across studies reinforces the implications of any single study taken by itself.

The second general observation, holding aside issues of potential methodological weaknesses, is that many of the studies that failed to find a positive association between health insurance or medical care use and health do not obviously generalize to the current population of uninsured nonelderly adults and their families. Casual empirical observations of pre-Medicare/Medicaid data in the U.S., studies of inefficient medical

care use by the elderly or privately insured, and studies of birth outcomes may not be directly relevant to assessing the health benefits of extending health insurance to those who are currently without insurance coverage. Even if one accepts as valid the findings of the more methodologically sound studies that suggest little or no health benefit from additional medical care use by well-insured populations, it does not necessarily follow that the uninsured would not benefit both from health insurance coverage and from greater medical care use. Holding both points of view would not be inconsistent. In fact, it would seem to be both inappropriate and unfair to argue on the basis of these studies that the uninsured should be penalized, i.e., denied help in obtaining insurance coverage, because of the inefficient or excessive use of medical care by the well insured.

This review also gave explicit consideration to what one might call the Medicaid conundrum: why do so many studies find that people covered by Medicaid tend to have worse health outcomes than the privately insured? Why have several of the evaluations of the expansions of Medicaid coverage to more low income women and children failed to find positive effects on birth outcomes, children's health, or maternal health? To a large extent these anomalous findings can be attributed to a combination of factors:

(1) reverse causation from poor health to Medicaid coverage;

(2) significant differences across states' Medicaid programs and over time in their generosity of payment to providers;

(3) substitution of both other public programs and private insurance for Medicaid financing; and

(4) the fact that health insurance by itself may not be enough to overcome the effects of the substantial socio-economic deficits of many Medicaid recipients.

Again, it may not be appropriate to make inferences from the studies of earlier Medicaid expansions to the potential health benefits of extending health insurance to the currently uninsured, the majority of whom are in families with at least one working adult and who frequently have incomes too high to qualify for public insurance (especially for adults), but still too low to find the cost of private insurance affordable (Bovbjerg et al. 2002). For this population, there is substantial evidence that having health insurance would lead to better health.

The information in Table 9 summarizes selected studies to provide an overview of the conclusion that extending health insurance to the uninsured would improve both health and wealth. Eight studies of outcomes of specific diseases (breast cancer, colorectal cancer, cardiovascular disease, and trauma) found that the odds of dying within a particular time period were from about 1.2 to 2.1 times greater for an uninsured person with the particular condition compared to a privately insured person. Another seven studies of adult mortality from all causes found comparably higher relative odds of dying for the uninsured compared to the privately insured and quantitatively consistent estimated effects of greater medical care use. Eight studies of infant and childhood health outcomes also suggest that greater insurance coverage and greater resource use improve both birthweight and mortality rates. Other research cited above strongly suggests that the mechanism underlying these results is a combination of less preventive care, later diagnosis at a more advanced stage of disease, and less therapeutic care after diagnosis among the uninsured.

The studies consistent with the hypothesis that having health insurance improves health are a mix of research designs, statistical methods, populations, and time periods.

They include fairly standard "observational" analyses, analyses that make statistical adjustments for possible biases from reverse causation or unobserved differences in insured and uninsured populations, as well as several natural experiments. The remarkable degree of consistency across so many studies in terms of the effects of health insurance on health outcomes and on the intervening mechanisms — use of preventive services, timely diagnosis, adequate therapeutic care —makes a compelling, albeit circumstantial, case for the importance of health insurance coverage to the nations' health and wealth.

These studies vary in how they report their results, some as relative odds, some as relative risk ratios, and others as elasticities. Taking these differences into account, their estimates of the quantitative effect of extending health insurance coverage to all suggest that the mortality rates of the uninsured would decline by at least 5% and, depending on age and medical condition, by as much as 20-25%, with some studies suggesting that the reduction could be as high as 50%. This means, for example, that if the uninsured population has a current mortality rate of 10% for a particular disease or for a particular age-sex-race cohort, having health insurance could eventually reduce the mortality rate by between 0.5 to 5 percentage points.

Fewer studies have looked at subjective measures of health status (excellent, good, fair, poor), and virtually none at objective measures. What evidence there is, however, tends to be consistent: the uninsured are more likely to report having fair or poor health. If the effect of having insurance is comparable to its estimated impact on mortality, then extending insurance coverage to the uninsured could reduce the proportion of people reporting fair or poor health.

Studies of the inefficiency of hospital care associated with lack of insurance consistently find that the uninsured are significantly more likely than the insured to be hospitalized for conditions that could be prevented or treated on an ambulatory basis if good care were provided on a timely basis. Estimates suggest that 3-5% of hospital days used by the uninsured represent avoidable care and should be counted as inefficiency due to the lack of insurance.

Both the extra years of life and more healthy years of life would add to individuals' and families' earnings, as well as to our national wealth. Depending on the measure of health used, changing a person's health to good/excellent from fair/poor or reducing the prevalence of a particular health condition could increase annual earnings by 10 to 30%. More efficient use of hospital resources would also reduce costs, which could be redirected to providing basic primary care services for those who are uninsured. Over the long term, expanded medical care coverage should lead to improvements in both childhood health and educational attainment.

If one accepts the hypothesis that expanding health insurance coverage to the uninsured would create a range of health benefits and improve medical care efficiency, then the next step for research should be to estimate the size of the potential benefits. How much would labor force participation increase? How much would incomes and tax revenues increase? What might be the effects on disability transfer payments? What are the implications for both Medicare and Medicaid spending of having a healthier population?

Estimates of the size of the potential benefits should become a prominent part of the policy debate over expanding health insurance coverage. Ideally, these estimates

should help move the process from a focus on whether health insurance is worthwhile or does any to good to the difficult questions of how to expand and finance insurance coverage to all Americans.

Skeptics may still argue that this evidence is suspect, since it is not based on true experiments that randomly assign people to either having or not having insurance. If political action continues to stall because of doubts about the health benefits of health insurance coverage, then it may be time to consider a new health insurance experiment. Rather than focusing on the effects of cost-sharing on medical care use and outcomes in a general population, as did the RAND Health Insurance Experiment (Newhouse et al. 1993), the population for the new experiment should be drawn from those who are currently uninsured. Participating families would be randomly assigned to a treatment group that receives insurance coverage, or to a control group that remains uninsured (at least initially), but is compensated for their continued participation in the study. Following both groups over a sufficiently long time would provide important information for policy. To what extent is lack of insurance a short-term rather than a long-term problem for specific families? How many of the uninsured eventually gain insurance? How much medical care do they receive? Where do they get it and how do they pay for it? Most importantly, periodic health status comparisons between the continuously insured treatment group and the control group should settle the question of whether having health insurance improves health.

How large are the potential benefits from improved health? Life expectancy at birth increased about 12% over the second half of the 20th century, from roughly 68 to 76 years. Nordhaus (2002) has estimated that the value of this health improvement is

approximately the same as the value of all of the increased consumption of non-medical goods and services that occurred over this time period. This calculation represents essentially another perspective on the conclusions drawn by Cutler and Richardson (1998), Cutler, McClellan and Newhouse (1998), and Cutler and Meara (1999), who have calculated, both in general and for treatment of specific conditions (cardiovascular disease and low birthweight babies), that the benefits in terms of increased longevity and quality of life have substantially exceeded the costs of increased medical care use over the last 30-40 years.

APPENDIX TABLES

TABLE 1

STUDIES OF CANCER OUTCOMES

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find Worse Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Roetzheim, Gonzales, Ferrante et al. 2000	11,113 incident cases of breast cancer in Florida in 1994	After three years, uninsured had a higher relative risk (RR)[1] of death (RR=1.31) compared to private fee-for-service (FFS) insurance. The higher risk was due to diagnosis at later disease stage.	Logistic regression controlling for age, race/ethnicity, marital status, education, smoking status, and community income; large sample; cancer incidence unlikely to be related to unobservable health differences	Observational data (Data not generated by a randomized or natural experiment may be prone to selection bias or effects of causation from health outcome to insurance coverage or medical care use. Results may also be biased due to unobservable differences between populations.)
Roetzheim, Pal, Gonzales et al. 2000	9,551 incident cases of colorectal cancer in Florida in 1994	After three years uninsured had a higher relative risk of death (RR=1.40 - 1.64) compared to private FFS insurance; higher relative risk persisted even after controlling for stage and treatment.	Logistic regression controlling for age, sex, race/ethnicity, marital status, education, smoking status, comorbidity, and community income; large sample; cancer incidence unlikely to be related to	Observational data

[1] Relative Risk (RR), which is the ratio of two probabilities, and Relative Odds (RO) or Odds Ratio (OR), which is the ratio of two sets of odds (p/1-p), are alternative ways of comparing the probabilities of events in different populations. When the probability of an event occurring is small, as is usually the case for adverse health outcomes, the relative risk and the relative odds (or odds ratio) will be numerically similar. For a more detailed explanation, see "Primer on Probability, Odds and Interpreting Their Ratios," *Effective Clinical Practice*, May/June 2000, http://www.acponline.org/journals/ecp/primers/mayjun00.htm.

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
			unobservable health differences	
Lee-Feldstein et a. 2000	1,788 nonelderly women with new cases of breast cancer in northern CA., 1987-1993	Uninsured and publicly insured women were significantly more likely than privately insured a)to be diagnosed at late-stage (Odds Ratio (OR) = 2.00) and b)to have died up to 5 years later (OR=1.42-1.46)	Logistic regression controlling for stage, treatment, and ethnicity; cancer incidence unlikely to be related to unobservable health differences	Observational data; combined uninsured and publicly insured due to small sample size
Ferrante et al. 2000, Roetzheim et al. 1999	29,237 incident cancer cases in Florida in 1994	Uninsured significantly more likely to be diagnosed with late-stage disease for melanoma (OR=2.59), colorectal (OR=1.67), breast (OR=1.43), prostate (OR=1.47), and cervical (OR=1.60) cancers	Logistic regression controlling for age, sex, marital status, education, income, and comorbidity; Large sample; cancer incidence unlikely to be related to unobservable health differences	Observational data
Ayanian et al. 1993	4,675 nonelderly women with new cases if breast cancer in NJ, 1985-1987	Uninsured significantly more likely than privately insured a)to be diagnosed at late-stage (OR=1.89) and b)to have died up to 5 years later (OR=2.0)	Proportional hazard model controlling for age, race, marital status, comorbidity, disease stage, and community income; cancer incidence unlikely to be related to unobservable health differences	Observational data
Penson et al. 2001	860 men diagnosed with prostate cancer in 1995	Uninsured had same quality of life at diagnosis, but significantly lower quality of life over 3-year follow-up observation period.	Mixed model analysis of covariance controlling for education, race, income, marital status, clinical characteristics, and treatment; cancer	Observational data; small sample

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
			incidence unlikely to be related to unobservable health differences; use of validated quality of life instrument	
Studies that Find No Difference in Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Greenberg et al. 1988	1,808 people with non-small-cell lung cancer in NH and VT, 1973-1976	4-7 year survival not related to insurance status, although privately insured received more aggressive therapy	Proportional hazard model controlling for age, sex, marital status, travel distance, comorbidity, stage, and functional status	Observational data; type of cancer generally not amenable to treatment; combined uninsured with Medicare and Medicaid
Hadley 1982	Age-race-gender specific cancer mortality rates (all sites) across 294 (black males, 65+) to 796 (whites) county groups in 1970	Measure of per capita medical spending not significantly related to cancer mortality rate	Instrumental variable estimation of "health production function"	Validity of instrumental variable not tested; combines all cancers; medical treatments for many cancers not well developed in 1970

TABLE 2

STUDIES OF CARDIOVASCULAR DISEASE OUTCOMES

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find Worse Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Canto et al. 2000	332,221 people from national registry of heart attack patients, 1994-1996	Uninsured had significantly higher in-hospital mortality (OR = 1.29) compared to privately insured	Logistic regression controlling for age, race, sex, prior history, clinical characteristics, and time to hospital; large sample	Observational data
Hadley, Steinberg, and Klag 1992	534 nonelderly adults who died of AMI in 1986, from the National Mortality Followback Survey	Age at death was two years younger for uninsured compared to privately insured; uninsured 1.8 times more likely than insured to have died of their first heart attack	Multivariate linear and logistic regression controlling for race, marital status, income, heart attack history, weight, exercise, smoking status, and activity limitations; observational data bias less likely because all cases died of same condition.	Small sample size; observational data
Young and Cohen 1991	4,972 emergency nonelderly heart attack patients in Massachusetts in 1987	Uninsured more likely to die in-hospital (OR = 1.54) and within 30 days of discharge (OR = 1.57) compared to privately insured;	Logistic regression controlling for age, clinical condition, sex, age, income, and hospital; potential observational data bias mitigated by limitation to emergency heart attacks; Medicaid cases excluded	Observational data

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Manning et al. 1987	Low income people with high blood pressure	People assigned to cost-sharing plan had less reduction in blood pressure than people on free plan; estimated to be equivalent of 10% higher mortality risk	Multivariate analysis of data from randomized experiment	Not designed to test lack of insurance (100% cost sharing) to average private insurance (average of 15-20% cost sharing); small sample
Lurie et al. 1984, 1986	215 adults who lost Medicaid coverage in CA in 1982 due to budget cuts; 109 adults in comparison group	Experienced significant reduction in access to medical care; significant increase in blood pressure at follow-up (6 and 12 months after losing coverage) among hypertensives	Natural experiment	Small sample
Hadley 1982	Age-sex-race specific cardiovascular mortality rates across 294-796 U. S. county groups in 1970	Per capita medical spending had significant negative association with mortality; 10% higher spending associated with 1.5-4.2% lower mortality rate, depending on age-sex-race cohort	Instrumental variable estimation of "health production function"	Validity of instrumental variable not tested.
Studies that Find No Difference in Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Sada et al. 1998	17,600 nonelderly people from national registry of heart attack patients, 1994-1995	Uninsured had higher risk of in-hospital mortality compared to privately insured, but not statistically significant. (Unadjusted in-hospital mortality rates were 5.4% for uninsured, 3.8-3.9% for privately insured)	Stepwise logistic regression	Observational data; limited to patients admitted to hospitals with invasive cardiac procedure capacity; does not have as extensive control variables as Canto et al. (2000)
Kreindal et al. 1997	3,735 residents of Worcester MA hospitalized for AMI, 1986-1993	No difference between uninsured and privately insured in in-hospital mortality		Observational data over long time period; single community; only 191 uninsured cases

TABLE 3

STUDIES OF DIABETES, RENAL DISEASE, AND LIVER DISEASE OUTCOMES

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find Worse Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Obrador et al. 1999	155,076 patients who started dialysis between 1995 and 1997 and had valid Medical Evidence Forms in the U.S. Renal Data System	Relative to people with private insurance at entry to dialysis, the uninsured had significantly higher relative odds of hypoalbuminemia (OR=1.37), low hematocrit (OR=1.34), and no EPO use (OR=2.04)	Logistic regression controlling for age, gender, race, employment status, diabetes, and mobility	Observational data
Powe et al. 1999	Random sample of 4,005 hemodialysis patients and 913 peritoneal dialysis patients who began dialysis in 1986-87 and had completed baseline data forms	Over 7 years of follow-up, uninsured patients on peritoneal dialysis were significantly more likely to be hospitalized for septicemia (OR=2.69), which is a significant factor in subsequent mortality; insurance was not related to septicemia risk for hemodialysis patients	Logistic regression controlling for age, gender, race, education, and medical condition; applied to longitudinal data	Observational data; reference group was combination of private or Medicare insurance coverage at entry to dialysis
Harris 2001	National samples of 590 whites, 405 African-Americans, and 450 Mexican-Americans from the 1988-94 National Health and Nutrition Examination Survey with type 2 diabetes	Uninsured African-Americans were significantly less likely to have good blood glucose control (OR=0.27) and low albumin-to-creatinine ratio (OR=0.37).	Logistic regression	Observational data; control variables not clearly specified; independent variables included measures of medical care visits, and primary source of ambulatory care, which could confound estimates of insurance effects

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Kim et al. 2001	Hospital discharge abstracts from the 1995 Healthcare Cost and Utilization Project: 26,700 cases of hepatitis C and 101,200 cases alcohol related liver disease	Compared to privately insured, those with Other (self-pay) payment had significantly higher odds of in-hospital mortality (OR=1.33 for hepatitis C; OR=1.18 for alcohol related liver disease)	Logistic regression controlling for age, gender, race, region, hospital type; also controlled for case severity	Observational data

TABLE 4

STUDIES OF TRAUMA AND OTHER DISEASE OUTCOMES

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find Worse Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Haas and Goldman 1994	All nonelderly adults (15,008) hospitalized in Mass. in 1990 for **emergency acute traumas**	Compared to privately insured, uninsured were as likely to receive intensive care, but significantly less likely to receive operative care (OR=0.68) and significantly more likely to die in a hospital (OR=2.15)	Large sample that experienced presumably exogenous health shocks; logistic regression controlling for age, sex, race, injury severity, and comorbidities	Observational data
Curtis et al. 1997	189 patients born with **cystic fibrosis** between 1955-1970 and hospitalized at a university referral center	Uninsured patients were 2.1 times more likely to die than privately insured patients during the observation period 1991; median survival for uninsured was 6.1 years compared to 20.5 years for privately insured	Cox proportional hazard model controlling for age, gender, severity at diagnosis, and socio-economic status; genetic disease presumably independent of insurance status	Observational data; small sample; single site
Yergen et al. 1988	4,369 patients hospitalized for **pneumonia** between 1970-73 in 17 randomly selected hospitals with discharge abstract data	Controlling for patient health, race, and hospital, self-pay patients had a significantly higher ratio (1.38) of actual to expected in-hospital mortality.	Expected mortality estimated from regression model based on age, sex, height, weight, admission test results, comorbidity, and hospital	Observational data

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Braveman et al. 1994	96,587 nonelderly adults hospitalized for **acute appendicitis** in California, 1984-1989	Uninsured were significantly more likely to have a ruptured appendix compared to private HMO patients (OR=1.46) and other privately insured patients (OR=1.22)	Logistic regression controlling for age, sex, race, hospital characteristics, diabetes, psychiatric diagnosis, emergency admission, poverty in community; onset of appendicitis unlikely related to insurance status; large sample	Observational data
Hadley and Steinberg 1996	Samples of hospital discharge abstracts for 13,885 children between the ages 6-18 and 3,907 women ages 19-50 with **acute appendicitis** drawn from 11 states between 1986-1991	Uninsured were significantly more likely to have a ruptured appendix compared to privately insured (OR=1.47 for kids; OR=1.76 for adult women)	Logistic regression controlling for age, gender, and community characteristics (based on zip code of residence); onset of appendicitis unlikely related to insurance status; multi-state sample	Observational data
Studies that Find No Difference in Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Gadomski and Jenkins 2001	5,141 children under age 18 admitted to Maryland hospitals between 1989-1993 with **acute appendicitis**	Self-pay patients had a higher but not statistically significant odds of ruptured appendix (OR=1.11) compared to privately insured	Logistic regression controlling for age, gender, race, hospital size, and time period	Maryland had a hospital rate setting program designed to offset costs of uncompensated care; observational data
Schnitzler et al. 1998	Hospital discharge abstracts for 21,149 nonelderly adult patients on **ventilator support**; 1989-1992 Healthcare Cost and Utilization Project	Uninsured had significantly lower odds of inpatient mortality compared to private, non-HMO patients (OR=0.87)	Logistic regression controlling for age, gender, race, hospital characteristics, and area income; limited to a single DRG	Observational data; may be subject to selection bias if uninsured less likely to receive ventilator support or if uninsured on ventilator support are healthier

TABLE 5

STUDIES OF MEDICAL CARE USE, INSURANCE, AND ADULTS' GENERAL HEALTH OUTCOMES

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find Worse Health Outcomes associated with Less Medical Care Use				
Auster, Leveson and Sarachek 1969	Age-sex-race adjusted mortality across states in 1960	Ten percent greater health expenditures per capita associated with 1.2% lower mortality.	Instrumental variable (IV) estimation of health "production function;" observational estimate half as large as IV estimate.	Small sample; crude measures; old data; IV not validated
Hadley 1982	Age-sex-race specific mortality across U.S. county groups in 1970, from 294 areas for black males to 796 for whites	Ten percent higher medical care spending per capita associated with significantly lower mortality: 0.7-3.2% for males and 1.3-1.7% for females.	IV estimation of health production function; observational estimates one-half to one-third smaller for whites	IV not validated.
Hadley 1988	Race-sex specific mortality rates for elderly age cohorts (65-69, 70-74, 75+) in 1980; 857 county groups for whites, 106-197 for blacks	Ten percent higher Medicare spending per beneficiary associated with significantly lower mortality: 2.5-4.4% for whites and 5.6-9.6% for blacks. (Significant effects on cancer and cardiovascular mortality)	IV estimation of health production function; observational estimates 35-70% smaller; better quality data than in Hadley (1982)	IV not validated
Lichtenberg 2001	Annual age-specific mortality; physician visits by age; annual bed-days by age	Medicare coverage at age 65 increases medical care use; 10% increase in use (physician visits) associated with 5% lower mortality; also estimated 13% reduction in bed-days after age 65 relative to expected use projected from younger age cohorts	Regression analysis applied to various cross-section and time-series data	Natural experiment based on near-universal Medicare coverage at age 65

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Lichtenberg 2002	Annual longevity at birth, 1960-1997	Ten percent increase in health spending per capita associated with 0.7-0.9% increase in longevity.	IV estimation of health production model adjusting for effects of correlation over time	Highly aggregated model with very few control variables
Studies that Find Worse Health Outcomes associated with Lack of Insurance				
Franks, Clancy and Gold 1993	4,694 nonelderly adults who were uninsured or privately insured and participated in the 1971-1975 National Health and Nutrition Examination Survey.	Uninsured had significantly higher relative risk of death compared to privately insured (RR = 1.25); over 17 years of follow-up, 18.4% of uninsured died compared to 9.6% of privately insured	Cox proportional hazard model controlling for baseline age, sex, race, education, income, employment status, self-rated health, morbidity, exercise, smoking, obesity, and alcohol use	Insurance status measured only at baseline, which may bias results toward finding no difference; observational data
Fihn and Wicher 1988	157 adults who lost outpatient coverage at VA medical center due to budget reduction; comparison sample of 74 similar adults	After 17 months of follow-up, those who lost coverage significantly more likely to report health as much worse (41% compared to 8%); twice as many reduced use of prescribed medicines (47% compared to 25%); after 13 months, uncontrolled high blood pressure more likely (41% compared to 17%)	Natural experiment	Small sample size
Hadley, Steinberg and Feder 1991	National sample of 510,436 hospital discharges in 1987 for 12 age-sex-race specific nonelderly, adult population groups	Uninsured had significantly higher regression-adjusted probabilities of in-hospital mortality, ranging from 8% higher to 220% higher than privately insured	Multiple regression controlling for admission severity, Medicare case-mix score, hospital characteristics, and community type.	Observational data; limited to in-hospital mortality

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Sorlie et al. 1994	147,779 nonelderly adults surveyed by the Current Population Survey in 1982-1985 and linked to the National Longitudinal Mortality Study through 1987	Except for African-American adult women, uninsured had significantly higher relative odds of death after five years, compared to privately insured (OR = 1.2-1.5)	Cox proportional hazard model controlling for age and income; separate models estimated by race and sex; longitudinal data base	Observational data; very few control variables; insurance measured only at baseline; relatively short follow-up period
Kaspar, Giovaninni and Hoffman 2000	724 adults who either gained or lost insurance coverage between 1995-1997	Although differences not statistically significant, loss of insurance associated with greater likelihood of reporting fair/poor health status in 1997; reverse for those who gained insurance.	Logistic regression applied to longitudinal data; measures change in insurance status.	Observational data; small sample size
Fronstin and Holtmann 2000	53,948 wage and salary workers interviewed by the March 1999 Current Population Survey	Workers with insurance coverage 3-8% more likely to report themselves in good health compared to uninsured workers, depending on gender, employment status, and firm size.	Multivariate regression controlling for age, marital status, family income, education, race/ethnicity, and occupation	Observational data
Bradbury, Golec and Steen 2001	Hospital discharge data for 29,237 nonelderly adults admitted for 19 common diagnoses to national sample of 100 hospitals in 1993-94	Compared to privately insured, uninsured more likely to be admitted for more severe conditions (OR = 1.13), and more likely to die in-hospital (OR = 1.37) or leave against medical advice (OR = 4.74)	Logistic regression controlling for condition severity, diagnosis, sex, age, and hospital characteristics	Observational data

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Baker et al. 2001	7,577 adults, ages 51-61 in 1992, from National Health and Retirement Survey	Over 4 years, continuously and intermittently uninsured were significantly more likely to have a major health decline than continuously insured (ORs = 1.63 and 1.41)	Logistic regression applied to longitudinal data ; measures changes in insurance coverage over time; extensive controls for baseline health conditions, age, sex, race, ethnicity, marital status, education, income, smoking, alcohol use	Observational data; relatively short follow-up period
Studies that Find No Difference in Health Outcomes associated with Lack of Insurance, Less Medical Care Use, or Fewer Medical Resources				
Skinner, Fisher and Wennberg 2001	Age-sex-race adjusted mortality of Medicare fee-for-service beneficiaries across 306 hospital referral regions in 1995-96	Variations in Medicare expenditures per beneficiary have no effect on variations in mortality rates.	Multivariate regression controlling for sources of illness, measures of income, and other area characteristics; uses validated instrumental variable estimator	Age-sex-race adjusted mortality rates may distort true underlying rates; hospital referral regions may mask intra-area variations.
Newhouse et al. 1993	Specific health measures for approximately 500-3,500 individuals randomly assigned to either free care or one of 13 insurance plans with varying amounts of cost sharing; 3-5 years beginning in 1974-1977	Amount of medical care use increased as cost sharing decreased; no appreciable differences in health measures between free care and cost-sharing groups; low-income people at high risk of elevated blood pressure had better blood pressure control under free care	Randomized experiment	Not designed to test differences between people with and without insurance; ability to generalize to current uninsured population may be limited

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Fisher et al. 2000[2]	Mortality among 20% sample of Medicare beneficiaries in 1989 across 313 hospital referral regions	Beneficiaries who lived in areas with more hospital beds per capita did not have reduced odds of death	Logistic regression analysis controlling for age, race, sex, area characteristics	Observational data; beds per 100 beneficiaries is limited measure of medical care use.
Ross and Mirowsky 2000	2,592 respondents to the 1995 survey of Aging, Status, and Sense of Control, ages 18-95; health status at 1998 re-interview	Uninsured have same health status as privately insured; Medicaid and Medicare report worse health status	Multivariate regression controlling for education, race, age, gender, marital status, changes in economic status, baseline health	Observational data; 44% lost to follow-up; no adjustment for reverse causation between health and insurance status
Newhouse and Friedlander 1980	6,672 individuals from 39 geographic areas included in the 1959-1962 Health Examination Survey	No relationship between medical resources in area and measures of physiologic health	Multivariate regression, with and without instrumental variable estimation	Observational data; small number of geographic areas; resources in area may be poor proxy for individuals' actual medical care use; data from very early time period

[2] Fisher et al. (1994) and Wennberg et al. (1989) are similar studies.

TABLE 6

STUDIES OF BIRTH OUTCOMES: GESTATION AND BIRTHWEIGHT

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find More Medical Care Use or Having Insurance Are Associated with Increased Gestation or Birthweight				
Harris 1982	6,736 African-American women who terminated pregnancies in 1975-76 in Massachusetts	Prenatal care reduced odds of pre-term delivery, but had no effect in intra-uterine growth; timely initiation of prenatal care equivalent to an additional week of gestation	Treats prenatal care visits and pregnancy termination as jointly determined; uses IV method controlling for education, age, marital status, and prior pregnancy	Observational data; IV not validated
Rosenzweig and Schultz 1982	9,621 live births from 1967-69 National Natality Followback Survey	Delay in initiating prenatal care significantly associated with shorter gestation; six month delay associated with 4% reduction in gestation (1.6 weeks)	IV estimation of health production model controlling for age, smoking status, birth history, smoking, race, and community type; prenatal delay associated longer gestation in observational analysis	Observational data; IV not validated
Rosenzweig and Schultz 1983a	9,621 live births from 1967-69 National Natality Followback Survey	Prenatal care delay has statistically significant and negative effect on birthweight	IV estimation of health production model controlling for age, smoking status, birth history, smoking, and race; prenatal delay much smaller in magnitude and not significant in observational analysis	Observational data; IV not validated

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Grossman and Joyce 1990	22,607 randomly selected births and induced abortions in New York City in 1984	IV estimate of prenatal care delay has negative effect on birthweight: 1 month delay reduces birthweight by 1.2% for African-Americans and 0.7% for Whites (not statistically significant); observational analysis estimates 66-80% smaller in magnitude	IV estimation of health production model; treats induced abortion as jointly-determined selection effect; controls for parity, tobacco use, alcohol use, narcotics use, education, age, and marital status	Observational data; IV not validated
Cole 1994	State aggregated data from birth certificates for "high-risk" mothers (teenagers, unmarried), 1983-1990	10% expansion of Medicaid eligibility associated with significant decrease in prenatal care delay, 3.8-5.1% decrease in pre-term births, and 2.3-3.0% decrease in low birthweight births	Uses IV estimate of Medicaid eligibility expansions	Unable to identify precisely women affected by Medicaid eligibility
Hanratty 1996	Annual rate of low birthweight births across 204 counties in ten Canadian provinces, 1960-1975	Implementation of national health insurance in Canada increased prenatal care use and reduced the incidence of low birthweight by 1.3%.	Multivariate regression model controlling for marital status, area income, parents' ages, prior birth history, and province and year fixed effects; natural experiment	Does not analyze data for individual births

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Long and Marquis 1998	Matched birth and death certificates, Medicaid eligibility files, hospital discharge data for women who gave birth in Florida in 1988-89 (n=56,101) and 1991 (n=78,421)	Among women without private insurance in the two time periods, the percent with inadequate prenatal care declined by 14.1 percentage points (Kotelchuck index), and the rate of low birthweight births per 1000 declined by 6.1 (significantly different from 0, p = 0.05)	Multivariate regression analysis controlling for mother's age, education, marital status, ethnicity, birth history; natural experiment; combines uninsured and Medicaid to reduce selection effects	Single state with large county health department network
Liu 1998	Data on 84,747 live births and 32,606 induced abortions in Virginia, 1984	Depending on race (White or African-American), location (urban or rural), and model (IV with and without selection correction), a 10% decrease in prenatal delay increased birthweight by 0.3-1.7%, with only the smallest estimate not statistically significant.	IV estimation of health production model with selection correction for abortion or live birth and endogenous prenatal care delay, controlling for parity, education, age, and baby's sex	Single state; observational data
Studies that Find No Association between More Medical Care Use or Having Insurance and Gestation or Birthweight				
Haas et al. 1993	All singleton in-hospital births in Massachusetts in 1984 (n=57,257) and 1987 (n=64,346)	Rate of satisfactory prenatal care declined after Healthy Start implemented; no change in adverse birth outcomes for uninsured relative to insured	Natural experiment; standardized rates in 1987 based on mother's age, race, parity, education and marital status	Insurance status subject to selection bias; not possible to identify directly who was affected by program; single state

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Ray, Mitchell and Piper 1997	610,056 singleton births in TN between 1983-1991	Medicaid expansions increased Medicaid coverage of births and prenatal care use among high-risk women, but did not reduce likelihood of preterm or very low birthweight births	Natural experiment; difference-in-differences method across births grouped by education, age, and neighborhood income of mother to identify women most and least likely to be affected by expansion	Single state
Epstein and Newhouse 1998	All singleton in-hospital births before and after Medicaid expansions in SC (n=45,455 in 1988-89 and n=84,997 in 1990-91) and CA (n=241,284 in 1989[3] and n=958,738 in 1990-91)	Small improvement in initiation of timely prenatal care in SC but no improvement in birth outcomes; in CA, slight deterioration in timely initiation of prenatal care and no change in difference between uninsured/Medicaid and private insurance	Natural experiment; calculated standardized rates based on mother's age, race, education, and marital status	Insurance status subject to selection bias; not possible to identify changes in coverage for individuals; single states (California reduced support for Community Based Perinatal Services Program.)
Kaestner 1999	9,953 cases from the live birth sample of the 1988 National Maternal and Infant Health Survey	No statistically significant relationship between insurance status and birthweight; uninsured and Medicaid receive less prenatal care due to later initiation of care than privately insured	Multivariate regression using extensive controls for maternal socio-economic and health characteristics; also estimates IV model of effects of insurance status	Does not control for live birth selection

[3] First six months.

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Currie and Grogger 2000	Vital statistics data by state, 1990-1996	Increasing income eligibility for Medicaid had significant positive effects on odds of adequate prenatal care for Whites but not for African-Americans; no significant effect on low birthweight, but significant reduction in odds of fetal death for African-Americans	Multivariate logistic regression controlling for state policy variables, mother's age, education, marital status, parity, state, year, and state/year fixed effects	State policy variables may not fully capture variations in Medicaid eligibility
Meara 2001	5,189 Whites and 5,315 African-Americans from the 1988 National Maternal and Infant Health Survey	Various measures of insurance coverage and problems with prenatal care not significant in analysis of probability of low birthweight birth	Multivariate probit analysis controlling for income, education, maternal health habits, marital status, maternal health, proximity to abortion provider, abortion laws	Observational data
Dubay et al. 2001	All births (8.1 million) from National Natality Files in 1980, 1986, and 1993	Significant reduction over time in rate of late initiation of prenatal care; very small reduction in rate of low birthweight for some White women of low socio-economic status, and no significant effects for other Whites and all African-Americans	Difference-in-differences analysis of changes between 1980-86 and 1986-93	Imprecise identification of women affected by changes in Medicaid; assumes that secular changes over first time period is a control for unobserved secular changes in second period

TABLE 7

STUDIES OF BIRTH OUTCOMES: INFANT SURVIVAL

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find More Medical Care Use or Having Insurance Are Associated with Greater Infant Survival				
Hadley 1982	Infant mortality rates by sex and race across county groups in 1970 (n=387 for Whites and 113 for African-Americans)	10% higher spending per capita associated with 1.5-2.0% significantly lower infant mortality rate; pediatricians and obstetricians per 1000 pop also associated with significantly lower infant mortality rates by 0.7-1.0%.	IV estimation of health production function using Medicare spending per beneficiary as instrument	Observational data; relatively few controls for maternal characteristics; instrument quality not validated
Rosenzweig and Schultz 1983b	8,119 live births from 1967-69 National Natality Followback Survey	Prenatal care delay has a positive and statistically significant effect on infant mortality	IV estimation of health production model controlling for smoking, mother's age, race, mother's work status, breastfeeding, and sex of infant; prenatal care delay associated with lower infant mortality in observational analysis	Observational data; IV not validated
Corman and Grossman 1985	Race-specific neonatal mortality rates across large counties in 1977 (n=677 for Whites and 357 for African-Americans)	10% greater availability of newborn intensive care associated with about 0.5% lower neonatal mortality, statistically significant for Whites but not for African-Americans; Medicaid policy variables not significant	Multivariate regression controlling for poverty status, education, Medicaid policy characteristics, abortion providers, and family planning, community health, and WIC	Observational data; crude measures of Medicaid policy characteristics; no adjustment for possible endogeneity bias

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
			program availability	
Corman, Joyce and Grossman 1987	Race-specific neonatal mortality rates across large counties in 1977 (n=677 for Whites and 357 for African-Americans)	Availability of neonatal intensive care reduces mortality, controlling for birthweight; early initiation of prenatal care also associated with lower mortality in models without birthweight	Multivariate regression controlling for abortion rates, maternal age, smoking, poverty, and pregnancy related public health programs; IV estimation treating neonatal intensive care and prenatal care initiation as jointly determined with mortality finds larger effects	Observational data
Corman, Grossman and Joyce 1988	State data on neonatal mortality rates by birthweight in 1980	Statistically significant association between availability of neonatal intensive care and lower neonatal mortality for low birthweight births, but not for normal weight births	Multivariate regression controlling for abortion providers, Medicaid coverage of first-time pregnancies, education, and pregnancy-related public programs	Observational data; small sample
Braveman et al. 1989	Adverse birth outcomes (long stay, transfer, or death) in California, 1982-1986, n = 146,468	Compared to privately insured newborns, uninsured had higher relative risk of adverse outcome (RR=1.11 in 1982, 1.19 in 1984, and 1.31 in 1986).	Logistic regression controlling for race, ethnicity, gestation, multiple births, and congenital anomalies	Observational data

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Hanratty 1996	Annual rate of low birthweight births across 204 counties in ten Canadian provinces, 1960-1975	Implementation of national health insurance in Canada increased prenatal care use and reduced county level infant mortality by 4.0%	Multivariate regression model controlling for marital status, area income, parents' ages, prior birth history, and province and year fixed effects; natural experiment	Does not analyze data for individual births
Currie and Gruber 1996a	Infant mortality rates across states between 1979 and 1992	Thirty percentage-point expansion of Medicaid eligibility to more low-income pregnant women decreased infant mortality rate by 8.5%.	Multivariate regression with IV for Medicaid eligibility, state- and year-specific effects, and measures of time-varying factors within states	Imprecise identification of target populations; dependent variable measures infant mortality for all infants in state
Moss and Carver 1998	9,953 live births and 5,332 infant deaths from the 1988 National Maternal and Infant Health Survey	Compared to privately insured, uninsured babies had higher relative odds of dying (RO=1.4-2.8, depending on control variables)	Logistic regression controlling for mother's age, education, race, ethnicity, birth history, income, WIC use, breast feeding, smoking, birthweight, and gestation	Observational data
Lee et al. 1998	371,692 singleton live births with breech presentation, U.S. birth cohorts 1989-1991	Vaginal deliveries had significantly higher birthweight-specific neonatal mortality than C-section deliveries (R.O. = 2.35-2.59 for vaginal delivery)	Logistic regression controlling for birthweight	Observational data; limited control variables

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Cremieux, Ouellette and Pilon 1999	Gender-specific infant mortality in Canadian provinces, 1978-1992.	Higher per capita medical spending and greater physician availability are both significantly related to lower infant mortality rates; a 10% higher level of spending is associated with 0.4-0.5% lower mortality rates.	Multivariate regression controlling Province, income, education, population density, lifestyle and nutritiom indicators; natural experiment; very accurate data on medical spending	Observational data;
Malkin, Broder and Keeler 2001	108,551 births in Washington state in 1989-90	12-hour increase in newborn length of stay associated with reduced probability of readmission of 0.6% (mean prob. of readmit = 2.5-4.9%)	Instrumental variable estimation controlling for parents' characteristics and newborn's health	Observational data
Studies that Find No Association between More Medical Care Use or Having Insurance and Infant Survival				
Grossman and Jacobowitz 1981	3-year (1970-1972) neonatal mortality rates across U.S. counties with minimum population sizes by race (679 counties for Whites and 359 counties for African-Americans)	Physicians per capita in the county and indicators of whether the state Medicaid program covers first-time births not associated with neonatal mortality	Multivariate regression also controlling for area level measures of income, education, presence of maternal and child health or family planning programs, and abortion rates	Observational data; crude measures of prenatal care and Medicaid eligibility; no correction for joint relationship between mortality and resource use

TABLE 8

STUDIES OF MATERNAL AND CHILD HEALTH OUTCOMES

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Studies that Find Worse Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Currie and Gruber 1996b	Childhood (ages 1-14) mortality rates across states between 1984 and 1992.	Doubling Medicaid eligibility percentage reduced childhood mortality by 5-9%.	Multivariate regression with IV for Medicaid eligibility, state- and year-specific effects, and measures of time-varying factors within states	Imprecise identification of target populations; dependent variable measures infant mortality for all infants in state
Holl et al 2000	1,730 children enrolled in children's health insurance program in western New York, 1991-1993	Parents of 25% of children reported health improvement, 67% reported no change in health, and only 0.2% reported a health decline	1-year follow-up interviews with parents	Observational data, no multivariate analysis
Lave et al. 1998	1,031 newly enrolled children in expanded children's health insurance program in western Pennsylvania and 460 comparison children, 1995	Proportion of children reporting any unmet medical need or delayed care in past 6 months decreased from 57% at baseline to 16% after 1 year	Comparisons after 1 year with baseline and with controls	Observational data; no multivariate analysis
Feinberg et al. 2002	996 children enrolled in Massachusetts' children's health insurance program in 1998-99	Children uninsured for more than 6 months at enrollment had significantly higher reported need for service, but no difference in need for services while enrolled	Logistic regression controlling for income, language, race, family size, marital status, employment status, health status, and usual source of care	Observational data

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Keane et al. 1999	750 newly enrolled children in expanded children's health insurance program in western Pennsylvania, 1995	Children uninsured at baseline were significantly more likely to have activities limited because of lack of insurance compared to 1-year follow-up, when almost no children had activities limited because of insurance concerns	Logistic regression controlling for race, family size, maternal education, parent's employment status, and health indicators	Observational data
Haas and McCormick 1997	995 women who had a low birthweight baby, 1985-1987	After 5 years of follow-up, women who had 1 or more years of private insurance coverage during follow-up had significantly lower relative odds of reporting fair or poor health at follow-up (RO=0.4)	Logistic regression controlling for employment, income, child's morbidity, and additional pregnancies	Observational data
Studies that Find No Difference in Health Outcomes associated with Lack of Insurance or Less Medical Care Use				
Haas, Udverhalyi and Epstein 1993	All singleton in-hospital births in Massachusetts in 1984 (n=57,257) and 1987 (n=64,346)	Uninsured had a higher rate of adverse maternal outcomes, but there was no change relative to insured women after the passage of the Healthy Start program	Natural experiment	Insurance status subject to selection; not possible to identify directly who was affected by program; single state
Tilford et al. 2001	477 cases with admitting diagnosis of head trauma from 3 pediatric intensive care units	Uninsured had higher relative odds of mortality compared to private insurance (RO = 1.69), but not statistically significant	Logistic regression controlling for race and intensive care unit	Observational data; small sample; few control variables

STUDY	DATA	RESULTS	METHODOLOGY AND STRENGTHS	THREATS TO VALIDITY
Kaestner et al. 1999	12,467 children between ages 2-9 with low family income interviewed by National Health Interview Survey in 1989 or 1992	Very little evidence that insurance coverage associated with good-excellent health status or number of bed days; only significant association is a positive effect of Medicaid coverage relative to no coverage on odds of good-excellent health among minority children	Multivariate regression analysis controlling for age and sex of child, family income, mother's age, marital status, health status, education, and state and year effects; IV estimation of insurance coverage	IV not validated

Table 9

Summary of Results of Selected Studies

STUDY	OUTCOME	RESULTS[4]
SPECIFIC DISEASES		
Ayanian et al. 1993	Breast cancer stage at diagnosis and survival	Compared to privately insured, uninsured were 1.68 times more likely to be diagnosed with distant disease and 1.49 times more likely to have died 54-89 months after diagnosis.
Lee-Feldstein et al. 2000	Breast cancer stage at diagnosis and survival	Compared to privately insured, uninsured and publicly insured were 2.01 times more likely to be diagnosed with stage III/IV disease and 1.42 times more likely to have died from breast cancer after 53 months average follow-up time.
Roetzheim et al. 2000	Colorectal cancer treatment and survival	Compared to private fee-for-service patients, uninsured were less likely to receive definitive surgery (RO=0.57) and more likely to die within 36-48 months (RR=1.16-1.22)
Young and Cohen 1991	Emergency patients with acute myocardial infarction (AMI), treatment and outcome	Compared to fee-for-service patients, uninsured were less likely to receive coronary bypass graft surgery (RO=0.57) or angioplasty (RO=0.64), and more likely to die within 90 days of discharge (RO=1.57)
Canto et al. 2000	AMI patients (from the National Registry of Myocardial Infarction), treatment and outcome	Compared to commercially insured patients, the uninsured were less likely to receive coronary arteriography (RO=0.64), catheter based revascularization (RO=0.86), or coronary bypass surgery (RO=0.78), but more likely to die in the hospital (RO=1.29).
Hadley 1982	Age-sex-race specific cardiovascular disease mortality rates across geographic areas in 1970	A 10% higher level of medical care use per capita was associated with lower mortality rates (ranging from 1.5% to 4.2%, depending on the group).
Hadley 1988	Sex-race specific cardiovascular mortality rate across geographic areas for three Medicare age groups in 1980	A 10% higher level of Medicare spending per beneficiary was associated with lower mortality rates (ranging from 3.0 to 4.4% for Whites and 7.1 to 13.3% for Blacks, depending on the group).
Haas and Goldman 1994	Acute trauma treatment and mortality	Compared to privately insured, uninsured were less likely to receive an operative procedure (RO=0.68) and more likely to die in the hospital (RO=2.15)

[4] RO=relative odds, RR=relative risk; all reported results are statistically significant.

STUDY	OUTCOME	RESULTS[4]
ADULT MORTALITY		
Sorlie et al. 1994	General mortality over 5-year period for a longitudinal sample of 25-64 year olds at baseline	Compared to those with employer-sponsored insurance, uninsured had higher relative risk of dying (RR=1.2 for white men, RR=1.5 for white women, RR=1.5 for black men)
Franks, Clancy, and Gold 1993	General mortality over 12-16 years in longitudinal sample of adults	Compared to insured, uninsured had higher relative risk of dying (RR=1.25). Over the entire period, 18.4% of uninsured had died compared to 9.6% of insured.
Baker et al. 2001	Major health decline (including death) over 4 years in a longitudinal sample of 51-61 year olds at baseline	Compared to privately insured, uninsured had a higher relative risk of a major health decline (RR=1.41).
Hadley, Steinberg, and Feder 1991	General in-hospital mortality	Compared to privately insured, uninsured had a significantly higher odds of in-hospital mortality in 12 of 16 age-sex-race specific nonelderly population cohorts. (15 of the relative odds were greater than 1.00, and significant values ranged from 1.15 to 3.20.)
Hadley 1982	Age-sex-race specific all-cause mortality rates across geographic areas in 1970	A 10% higher level of medical care use per capita was associated with lower mortality rates (ranging from 0.7% to 3.2%, depending on the group).
Hadley 1988	Sex-race specific all-cause mortality rates across geographic areas for three Medicare age groups in 1980	A 10% higher level of Medicare spending per beneficiary was associated with lower mortality rates (ranging from 2.5 to 4.4% for Whites and 5.6 to 10.0% for Blacks, depending on the group).
Lichtenberg 2001	Natural experiment of becoming eligible for Medicare at age 65 on mortality and morbidity	Relative to projections based on trends prior to age 65, both morbidity (days in bed) and mortality decline 13%; a 10% increase in physician visits (as a proxy for greater medical care use) is estimated to reduce the age-specific mortality rate by 5%.
INFANTS' AND CHILDREN'S HEALTH		
Braveman et al. 1989	Adverse birth outcomes (long stay, transfer, or death) in California, 1982-1986	Compared to privately insured newborns, uninsured had higher relative risk of adverse outcome (RR=1.11 in 1982, 1.19 in 1984, and 1.31 in 1986).

STUDY	OUTCOME	RESULTS[4]
Currie and Gruber, 1996a	Infant mortality rates across states between 1979 and 1992	Thirty percentage-point expansion of Medicaid eligibility to more low-income pregnant women decreased infant mortality rate by 8.5%.
Currie and Gruber 1996b	Childhood (ages 1-14) mortality rates across states between 1984 and 1992.	Doubling Medicaid eligibility percentage reduced childhood mortality by 5-9%.
Liu 1998	Birthweight of 30,673 infants born to mothers age 20 or above in Virginia in 1984	Adjusting for the decisions to carry a pregnancy to term and to select into prenatal care increased the impact of prenatal delay on birthweight fivefold, to roughly 75 grams lower weight per month of delay.
Hanratty 1996	Infant mortality and the incidence of low birthweight in Canadian provinces, 1960-1974	Using variation in the implementation date of Canadian National Health Insurance as a natural experiment, expanded insurance coverage reduced infant mortality by 4% and the incidence of low birthweight by 1.3-2.7%.
Cremieux, Ouellette, and Pilon 1999	Gender-specific infant mortality in Canadian provinces, 1978-1992.	Higher per capita medical spending and greater physician availability are both significantly related to lower infant mortality rates; a 10% higher level of spending is associated with 0.4-0.5% lower mortality rates.
Hadley 1982	Infant mortality rates by race and sex across geographic areas in 1970	Ten percent higher medical care spending per capita associated with 1.5 to 2.0% lower infant mortality rates.
Moss and Carver 1998	Neonatal mortality	Compared to privately insured, uninsured babies had higher relative odds of dying (RO=1.4-1.8)
AVOIDABLE HOSPITAL STAYS		
Kozak, Hall, and Owings 2001	Avoidable hospitalization rates, 1980 - 1998	Compared to privately insured, the relative rate of avoidable hospitalizations for self-pay patients has increased over time, from 24.3% in 1980 to 54.6% in 1998 (11.6% compared to 7.5% avoidable).
Pappas et al. 1997	Avoidable hospitalization rate, 1990	Compared to privately insured, uninsured had a 30% higher rate (13% compared to 10%).
Hoffman and Gaskin 2001	Cost of an avoidable hospital stay	Average cost of an avoidable hospital stay for an uninsured adult was $3,300 in 2002.

STUDY	OUTCOME	RESULTS[4]
HEALTH AND INCOME		
Chirikos and Nestel 1985	Annual earnings, 1976-1977	Compared to those in continuously good health, those in poor health earned less, depending on race and sex: white men (20.7%), black men (22.3%), white women (12.5%), and black women (27.8%)
Fronstin and Holtmann 2000	Annual earnings, 1998	Compared to those in good health, full-time workers in bad health earned from 6.2 to 18.1% less (average 11.3% less), depending on sex and firm size.

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