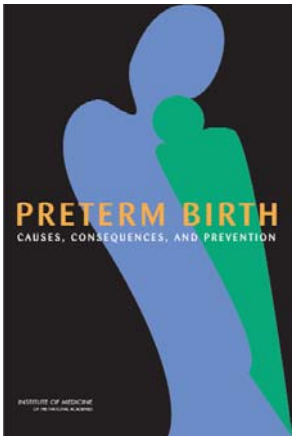
INSTITUTE OF MEDICINE

REPORT BRIEF • JULY 2006

PRETERM BIRTH: CAUSES, CONSEQUENCES, AND PREVENTION



The rate of preterm births in the United States is a growing public health problem that has significant consequences for families, and costs society at least $26 billion a year. Preterm births, defined as occurring before 37 weeks of gestation, now account for the troubling figure of 12.5 percent of all births in the United States (see Figure 1)—an increase of 30 percent since 1981. Full term infants are born between 38 and 42 weeks.

There are very troubling and persistent disparities in preterm birth rates among different racial and ethnic groups (see Figure 2). The highest rates are for African American women, and the lowest are for Asian or Pacific Islander women. In 2003, the rate for African-American women was 17.8 percent, while the rates were 10.5 percent for Asian and Pacific Islander women and 11.5 percent for white women. The most notable increases from 2001 to 2003 were for white, American Indian, and Hispanic groups. These disparities can not be fully explained by differences in socioeconomic conditions or maternal behaviors, such as smoking or drug use.

The growing problem of preterm births is not receiving the attention and funding necessary to fully understand its causes and identify ways to reduce the number of preterm deliveries. A report by the Institute of Medicine, *Preterm Birth: Causes, Consequences, and Prevention,* examines what is currently known about the causes of preterm birth; addresses the health, social-emotional, and economic consequences of preterm birth; and establishes a framework for action in addressing a range of priority issues, including a research and policy agenda for the future.

Preterm births, defined as occurring before 37 weeks of gestation, now account for the troubling figure of 12.5 percent of all births in the United States...

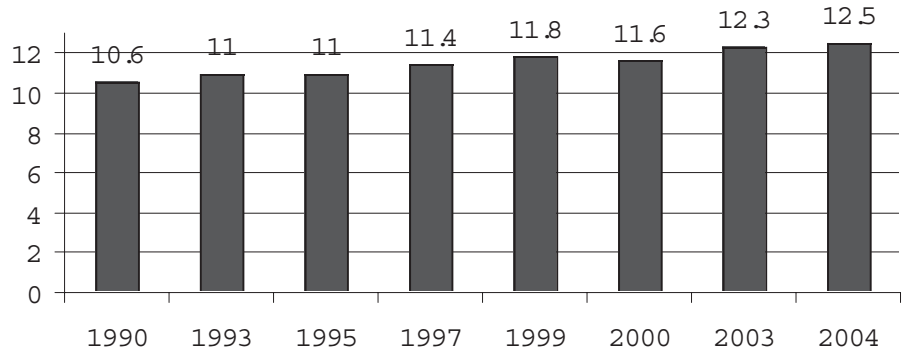


FIGURE 1. Preterm births as a percentage of live births in the United States, 1990 to 2004. SOURCES: CDC (2001, 2002, 2004a, 2005a).

INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

Advising the Nation. Improving Health.

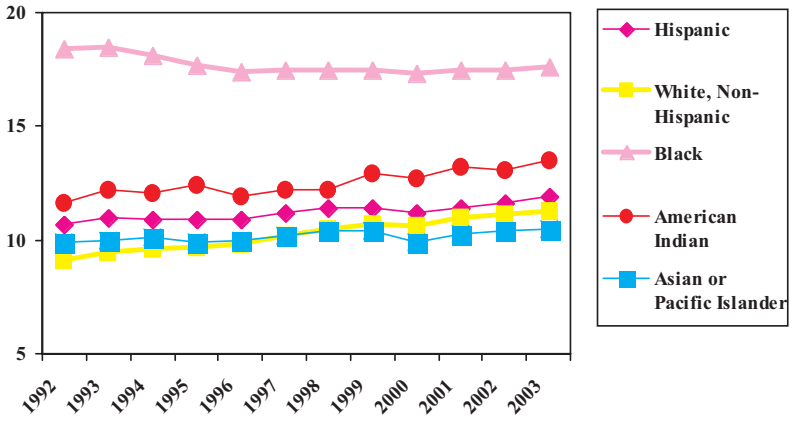


FIGURE 2. Preterm Births as a Percent of Live Births, by race and ethnicity, 1992 to 2003. SOURCE: CDC (2004a).

Babies born before 32 weeks have the greatest risk for death and poor health outcomes, however infants born between 32 and 36 weeks...are still at higher risk for health and developmental problems compared to those infants born full term.

CONSEQUENCES AND COSTS OF PRETERM BIRTH

Improvements in the treatment of preterm infants in Neonatal Intensive Care Units have helped to greatly improve their survival. However, these infants remain vulnerable to many complications, including respiratory, gastrointestinal, immune system, central nervous system, hearing, and vision problems. Longer-term problems may include cerebral palsy, mental retardation, visual and hearing impairments, behavior and social-emotional concerns, learning difficulties, and poor health and growth. Babies born before 32 weeks have the greatest risk for death and poor health outcomes, however infants born between 32 and 36 weeks, which make up the greatest number of preterm births, are still at higher risk for health and developmental problems compared to those infants born full term.

In general, the more immature the preterm infant, the greater the degree of life support that is needed and the longer the stay required in a Neonatal Intensive Care Unit. Hospital stays as a whole tend to be longer, while the risks of rehospitalization are greatly increased. The lifetime consequences for preterm children can be significant, and often call for a broad range of services and social supports.

The Committee estimates that the annual societal economic burden associated with preterm birth in the United States was at a minimum $26.2 billion in 2005, or $51,600 per infant born preterm. Nearly two thirds of this cost was for medical care. Medical care services contributed $16.9 billion ($33,200 per preterm infant) to the total cost, with over 85 percent of those medical care services delivered in early infancy. Maternal delivery costs contributed another $1.9 billion ($3,800 per preterm infant) and early intervention services cost an estimated $611 million ($1,200 per infant). Special education services associated with the higher prevalence of four major disabling conditions among preterm infants (cerebral palsy, mental retardation, vision impairment, and hearing loss) added another $1.1 billion ($2,200 per preterm infant). In addition, lost household and labor market productivity associated with preterm birth disabilities contributed $5.7 billion ($11,200 per preterm infant). Except for lifetime medical care costs associated with the four disabling conditions, the $26 billion estimate does not include the cost of medical care beyond early childhood or caretaker costs. However, it does include special education services and lost productivity costs for the four disabling conditions.

A LACK OF PROGRESS IN UNDERSTANDING CAUSES AND PREVENTION

There is a clear need to understand the causes of preterm birth. A host of socioeconomic, biological, and environmental factors contribute to a woman's risk for a preterm delivery. Medical conditions such as chronic hypertension, diabetes, infections, and stress are associated with preterm birth. In addition, a woman's medical history, such as a preterm birth in previous pregnancy, a family history of preterm birth, or if the woman herself was born preterm may also increase the risk. There are also problems brought about by infertility treatments which often result in twins and triplets who are more likely to be born preterm.

Studies indicate that many of the factors associated with preterm birth occur together, particularly in minority women or those who have low socioeconomic status. Although it is known that racial and ethnic factors play significant roles, these factors remain poorly understood or explained.

There is no test that can accurately predict preterm birth and little is known about how preterm birth can be prevented.

There is no test that can accurately predict a preterm birth and little is known about how a preterm birth can be prevented. Treatment has been primarily focused on slowing contractions. This has not reduced the number of preterm births, but has delayed delivery long enough to administer steroids to the mother to help prevent respiratory distress in the infant after birth and transfer the mother and fetus to a hospital where they may receive appropriate care. These interventions have helped reduce the rates of mortality and morbidity, yet therapies and interventions for the prediction and the prevention of preterm birth are still greatly needed.

RECOMMENDATIONS FOR THE FUTURE

To address the many unknowns about preterm birth, the committee offers a detailed agenda for the research that needs to be undertaken by a range of disciplines. The complexity of interrelated biological, psychological, social, and environmental factors that are involved in preterm birth necessitates a multidisciplinary approach to research directed at understanding its causes, biological pathways, diagnosis, and treatment. Given that so many factors are involved, the National Institutes of Health and private foundations should establish integrated multidisciplinary research centers to study the causes of preterm birth and outcomes for women and their children. In addition, researchers should focus on:

- Better defining the problem of preterm birth, including the use of ultrasound in the first trimester to accurately establish gestational age.
- Conduct studies to improve the clinical treatment of women who deliver preterm and infants born preterm, and the health care systems that care for them.
- Examine the multiple causes of preterm birth, including investigating reasons for disparities among differenct racial, ethnic, and socioeconomic groups.
- Conducting studies that will help increase our understanding of the impact of preterm birth on various public programs and policies and how policies can be used to reduce the rates of preterm birth.

What seems certain is that any progress in our understanding and prevention of preterm births requires acknowledgement that it is not one disease with a single solution or cure, but rather the product of overlapping factors. There will be no silver bullet. Any significant gains to be made in the study of preterm birth will be in the area of prevention. The goal of the committee's report is to assist policymakers, researchers, funding agencies and others pursuing the research necessary to address this public health problem. The ultimate goal is to work toward improved health and wellbeing for children and their families.

FOR MORE INFORMATION...

Copies of *Preterm Birth: Causes, Consequences, and Prevention* are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, http://www.nap.edu. The full text of this report is available at http://www.nap.edu.

This study was supported by funds from the National Institute of Child Health and Human Development, U.S. Centers for Disease Control and Prevention, Health Resources and Services Administration, U.S. Environmental Protection Agency, NIH Office of Research on Women's Health, March of Dimes, Burroughs Wellcome Fund, American College of Obstetricians and Gynecologists, American Society for Reproductive Medicine, and the Society for Maternal-Fetal Medicine. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the organizations or agencies that provided support for the project.

The Institute of Medicine serves as adviser to the nation to improve health. Established in 1970 under the charter of the National Academy of Sciences, the Institute of Medicine provides independent, objective, evidence-based advice to policymakers, health professionals, the private sector, and the public. For more information about the Institute of Medicine, visit the IOM home page at www.iom.edu.

COMMITTEE ON UNDERSTANDING PREMATURE BIRTH AND ASSURING HEALTHY OUTCOMES

RICHARD E. BEHRMAN (Chair), Executive Chair, Pediatric Education Steering Committee, Federation of Pediatric Organizations, Inc., Menlo Park, CA; **ELI Y. ADASHI,** Dean of Medicine and Biological Sciences, Brown University, Providence, Rhode Island; **MARILEE C. ALLEN,** Professor of Pediatrics, The Johns Hopkins Hospital, Baltimore, MD; **RITA LOCH CARUSO,** Professor, Environmental Health Sciences, Associate Research Scientist, School of Public Health, University of Michigan, Ann Arbor, MI; **JENNIFER CULHANE,** Associate Professor, Department of Obstetrics & Gynecology, Drexel University College of Medicine, Philadelphia, PA; **CHRISTINE DUNKEL SCHETTER,** Professor, Department of Psychology, Health and Social Psychology, University of California, Los Angeles, CA; **MICHEAL G. GRAVETT,** Professor and Vice-Chairman, Department of Obstetrics and Gynecology, University of Washington School of Medicine, Seattle, WA; **JAY D. IAMS,** Professor and Vice-Chairman, Department of Obstetrics and Gynecology, Ohio State University College of Medicine, Columbus, OH; **MICHAEL C. LU,** Assistant Professor, Department of Community Health Sciences, School of Public Health, Deparment of Obstetrics and Gynecology, School of Medicine, University of California, Los Angeles, CA; **MARIE C. MCCORMICK,** Professor, Department of Society, Human Development and Health, School of Public Health, Harvard University, Boston, MA; **LAURA E. RILEY,** Director, Labor and Delivery, Director, Infectious Disease, Massachusetts General Hospital, Boston, MA; **JEANNETTE A. ROGOWSKI,** University Professor, Department of Health Systems and Policy, School of Public Health, University of Medicine and Dentistry of New Jersey, New Brunswick, NJ; **SAROJ SAIGAL,** Professor of Pediatrics, Director, Neonatal Follow-up Program, Senior Scientist, CIHR, McMaster University, Hamilton, Ontario, Canada; **DAVID A. SAVITZ,** Professor, Department of Community and Preventive Medicine, Mount Siani School of Medicine, New York, NY; **HYAGRIV N. SIMHAN,** Assistant Professor, Divisions of Maternal-Fetal Medicine and Reproductive Infectious Diseases and Immunology, University of Pittsburgh, Magee-Women's Hospital, Pittsburgh, PA; **NORMAN J. WAITZMAN,** Associate Professor, Deparment of Economics, University of Utah, Salt Lake City, UT; **XIAOBIN WANG,** Director and Mary Ann and J. Milburn Smith Research Professor, Children's Memorial Hospital and Children's Memorial Research Center, Chicago, IL

IOM STAFF

ADRIENNE STITH BUTLER, Study Director; **EILEEN J. SANTA,** Research Associate; **THELMA L. COX,** Senior Program Assistant