



# Special Research Presentation



## **Low Birthweight and Infant Mortality in Puerto Rico**

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José Becerra, M.D., M.P.H.\*

Director  
Puerto Rico Maternal and Child Health Epidemiology Program  
Department of Health

### **Reaction**

Frances Mather, Ph.D.

Associate Professor  
Department of Biostatistics and Epidemiology  
Tulane University

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For more information, please contact Michelle Keyes-Welch, NCEMCH, (703) 524-7802.



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## About This Series

This research project is a cooperative venture between various divisions and branches within the Maternal and Child Health Bureau as well as the Centers for Disease Control and Prevention (CDC). The Maternal and Child Health Bureau's Research Program sponsored this special presentation.

The Maternal and Child Health Research Program is directed by Dr. Gontran Lamberty and administered through the Division of Systems, Education and Analysis, Maternal and Child Health Bureau, Health Resources and Services Administration (HRSA). HRSA is a component of the Public Health Service (PHS), U.S. Department of Health and Human Services (DHHS). The purpose of the research program is to support applied research relating to maternal and child health services that shows promise of substantial contribution to the advancement of these services.

## Introductions

After welcoming remarks from Dr. Audrey Nora, director of the Maternal and Child Health Bureau, Dr. Gontran Lamberty introduced the speaker and the reactor for the special research presentation. Dr. Becerra is director of the Puerto Rican Maternal and Child Health Epidemiology Program at the Department of Health in San Juan, Puerto Rico. His research interests include the translation of epidemiologic research findings into the realm of policymaking and the application of epidemiological methods to assessing the effectiveness of preventive health strategies. Dr. Mather is an associate professor in the Department of Biostatistics and Epidemiology at Tulane University. Dr. Mather worked closely with the Louisiana Pediatric Pulmonary Disease Center to design, implement, and maintain the longitudinal data base used to track patients.

This presentation had two objectives. The first objective was to present information on how the population of the Commonwealth of Puerto Rico fares with respect to low birthweight, infant mortality, and preterm birth. The separation of Puerto Rico from the U.S. mainland is not conducive to the dissemination of information about maternal and child health issues in the Commonwealth. The second purpose was to demonstrate how routinely collected information (in this case, vital statistics) could be used to define maternal and child health problems at the State and community levels and how, through descriptive and inferential epidemiology, one could arrive at probable causes. This information could also be used in public health policy discussions and program planning.

## Presentation

### *Statement of the Problem*

Unexplained differentials in infant mortality—one of the most widely used measures of health within a population—among various ethnic and racial groups are largely a reflection of the socioeconomic inequities among these groups. Puerto Ricans in both the continental United States and Puerto Rico have the highest incidence of low birthweight and infant mortality of all Hispanic groups in the United States, rates that are exceeded only by those for African Americans.

Three-fourths of all infant deaths occur in the neonatal period; two-thirds of these deaths are associated with low birthweight. The differential excess in mortality between mainland Puerto Ricans and other non-Hispanic whites is eliminated after adjustment for low birthweight. Differentials still remain after adjustment for birthweight among Puerto Rican islanders because of poorer survival by birthweight-specific categories.

Differentials in low birthweight are more difficult to explain. Compared with non-Hispanic whites, more than two-thirds of the excess risk of low birthweight among Puerto Ricans in the continental United States is accounted for by two sociodemographic variables: Maternal education and marital status. Among Puerto Rican islanders, only one-third of the excess risk of low birthweight compared with non-Hispanic whites is attributable to maternal education and marital status. Why do these variables behave differently for Puerto Ricans in the continental United States and Puerto Rican islanders?

In previous studies, investigators have implicated increased birthweight-specific neonatal mortality risks, smoking, and inadequate prenatal care as contributors to adverse pregnancy outcomes in Puerto Rico. However, no previous study has quantified the relative contributions of sociodemographic and socioeconomic factors to the high incidence of low birthweight and infant mortality in Puerto Rico.

### *Research Questions and Objectives*

This study had two objectives: (1) Assess the relative contributions of maternal age, marital status, maternal education, hospital of birth, and use of prenatal care to the high incidence of low birthweight and infant mortality in Puerto Rico; and (2) assess the relative independent contributions of these same factors to the incidence of infant mortality after accounting for the effect of birthweight. The ultimate goal of the study is to provide public health policymakers with accurate information that can assist in the design and implementation of prevention strategies to reduce the high incidence of low birthweight and infant mortality.

### *Study Design and Methods*

A multivariate modeling approach was used to determine how infant mortality would be influenced by sociodemographic variables that could predict low birthweight in Puerto Rico. After adjustment for low birthweight, how would these variables predict infant mortality? Four binomial regression models were used to calculate the adjusted population attributable risks for each variable. Two models included the combined effects of all the exposure variables on birthweight; the other two models added birthweight to the exposure variables and considered infant death as the outcome.

### *Population Description and Sampling Plan*

From 1986 to 1989, 258,354 births occurred among Puerto Rican residents. Infant death certificates from 1986 through 1990 were matched to corresponding birth certificates. Valid data for

the variables under study were available for 257,537 live births and 3,373 corresponding infant deaths, which constituted the population used in the study. In Puerto Rico, two-thirds of live births are delivered in public hospitals. Vital statistical race data was collected from the infant birth and death certificates, but it does not have the predictive value that it does in the mainland United States. In this study, the hospital of birth was used as a marker for socioeconomic status. Women who give birth in the public sector most likely do not have private insurance and may be medically indigent.

Compared with private hospitals for the year 1993, public hospitals had a higher incidence of low birthweight (12 vs. 8 percent), more mothers under 20 years of age (29 vs. 15 percent), higher percentages of unmarried mothers (55 vs. 18 percent), and more women initiating prenatal care after the first trimester (28 vs. 18 percent).

### *Findings*

Improvements in Puerto Rico's neonatal mortality rate have slowed down since 1986 because of increasing rates of low-birthweight infants and a neonatal survival rate well below U.S. standards. Of the 9 percent low-birthweight rate in Puerto Rico at the time of the study, 2.5 percent could be accounted for by the hospital of birth. If the gap in health outcomes between public and private hospitals were eliminated, infant mortality would decrease by 28 percent. The Governor of Puerto Rico, a pediatric surgeon, used these findings to illustrate the gap between public and private sector health care. The Governor indicated that these data demonstrated a double standard of health care in Puerto Rico and suggested that if public births were moved to the private sector, the rate of infant mortality would decrease automatically. This was a controversial suggestion because the epidemiological modeling used to calculate the rates could not distinguish whether this variable (hospital of birth) was a marker for other sociodemographic characteristics of the population that had not been accounted for within the model, or if it referred to the quality of services within the private and public sectors. Other risk factors such as marital status, maternal education and age, and lack of prenatal care accounted for 1 percentage point of the 9 percent low-birthweight differential; 5.5 percentage points of the 9 percent were not accounted for by any of the study variables.

After adjustment for low birthweight, hospital of birth was also an important correlate of infant mortality. This was a controversial finding. Can this be interpreted as a deficiency in the perinatal services in the public sector? The Governor of Puerto Rico used this research to call for more support for improved perinatal services in the tertiary care setting.

Dr. Becerra highlighted the interaction between maternal education and hospital of birth as a predictor of infant mortality. Among less-educated mothers, hospital of birth was no longer an independent correlate of infant mortality. Other sociodemographic variables and birthweight accounted for most of the difference between public and private hospitals. When groups of more-educated mothers (12 or more years of education) were analyzed, their offspring had a better chance of survival compared with the offspring of the less-educated mothers.

Eliminating risks associated with sociodemographic and socioeconomic factors (including hospital of birth) would potentially decrease the incidence of low birthweight in Puerto Rico, regardless of other factors considered in the study. This research suggests that efforts to prevent low birthweight and infant mortality in Puerto Rico should focus on reducing the gap between the private and public sectors.

Dr. Becerra concluded by reiterating the importance of this type of research in providing input into policy and program decisions. However, Dr. Becerra cautioned, data alone cannot change belief systems. Epidemiological research and data must be supported with a commitment from Federal, State, and local health systems.

## Reaction

Dr. Mather complimented Dr. Becerra on the research and its objective in educating public policymakers. This research also has the potential for guiding the development of programs addressing low-birthweight issues. Dr. Mather felt these uses of the study were the chief strengths of the research. Dr. Becerra also made recommendations as to how prevention strategies could be implemented in Puerto Rico—points that are often overlooked by epidemiology studies.

Because of its large sample size (more than 200,000), the study had the power to detect even moderate differences in mortality without difficulty. Dr. Mather also felt that the findings were clear and concise. The description of the models examining low birthweight and infant mortality was also very clear. The interaction terms among the variables were appropriately treated in the research. Dr. Becerra's use of interactional modeling and confidence intervals and the resulting findings were also presented carefully.

Dr. Mather discussed some concerns with the research study. The sample size is so large that even very small excesses can become statistically significant. There may be some difficulties in using multivariate models to examine predictors of perinatal mortality. The problem with using this type of analysis is that the decision of whether a variable is intervening or confounding is a biological rather than a statistical issue. The use of large birthweight categories may fail to model the effects accurately, and differences in the distribution of 200- to 250-gram intervals may be reflected in other coefficients. Multicollinearity may also be present because some of the variables are so closely related (e.g., maternal age, education).

Dr. Mather expressed some concern over the use of vital statistics data bases in making policy decisions since no psychosocial variables are included. There is growing concern that psychosocial issues as well as unidentified medical conditions that may contribute to poor pregnancy outcomes are not reflected in vital statistics research. There is also no data within the vital statistics record to discern or to control for the impact of intergenerational factors. Despite her concerns with the research, Dr. Mather felt that the study was well conducted and provided much needed information on the variables that affect infant mortality in this population.

## Discussion

Participants discussed maternal substance abuse and HIV infection and how these issues could impact infant mortality in the future. Participants recognized that this research has the potential to assist in studying migration patterns, but the interpretation of migration patterns is still in contention.

## Publications

Becerra JE, Hogue CJ, Atrash HK, Perez N. 1991. Infant mortality among Hispanics. *JAMA* 265:217–221.

Becerra JE, Atrash HK, Pérez N, Saliceti JA. 1993. Low birthweight and infant mortality in Puerto Rico. *American Journal of Public Health* 83:1572–1576.

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