Rapid Population-Based Surveillance of Prenatal and Postpartum Experiences During Public Health Emergencies, Puerto Rico, 2016–2018

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The Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response study, implemented in Puerto Rico during the Zika virus outbreak (2016–2017) and after Hurricanes Irma and María (2017–2018), collected pregnancy-related data using postpartum hospital-based surveys and telephone follow-up surveys. Response rates of 75% or more were observed across five study surveys. The study informed programs, increased the Puerto Rico Department of Health's capacity to conduct maternal–infant health surveillance, and demonstrated the effectiveness of this methodology for collecting data during public health emergencies. (*Am J Public Health*. 2022;112(4):574–578. https://doi.org/10.2105/AJPH.2021.306687)

AJPH April 2022, Vol 112, No. 4

In 2016, the Puerto Rico Department of Health (PRDH) and the Centers for Disease Control and Prevention implemented the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response (PRAMS-ZPER) study to address the urgent need for data on Zika virus infection ("Zika").

INTERVENTION

The study initially assessed Zika-related experiences and behaviors during pregnancy and later expanded to examine paternal involvement during pregnancy and the impact of Hurricanes Irma and María on access to maternal and infant health services. We describe the study methodology, which may be leveraged to rapidly respond to public health emergencies that affect maternal–infant health.

PLACE AND TIME

The PRAMS-ZPER study was implemented in Puerto Rico during the Zika outbreak (2016–2017) and after Hurricanes Irma and María (2017–2018). The two-phase study included hospital-based surveys conducted after delivery and telephone follow-up surveys conducted three to nine months postpartum. Phase 1 was fielded from August 2016 to June 2017, and phase 2 from November 2017 to April 2018. Phase 2 repeated the phase 1 maternal surveys (hospital-based and telephone follow-up) and added an in-hospital paternal survey and educational component (Tables 1 and 2).

PERSON

For both phases, women who had a live-born infant in selected hospitals and met eligibility criteria could participate. For phase 2, the paternal survey could be completed by the father of the sampled woman's live-born infant or by the woman's partner (including same-sex partners). Eligibility for the infants' fathers (or mothers' partners) was based on the mother being sampled, not on her participation in the survey.

After completing the in-hospital survey in phase 2, sampled mothers and infants' fathers (or mothers' partners) were offered the educational component. Interested family members (e.g., grandparents) were allowed to listen to the educational component if allowed by the participants.

PURPOSE

In February 2016, PRDH declared a public health emergency because of

TABLE 1— Study Methodology, Outcomes, and Resources for the In-Hospital Surveys of the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response (PRAMS-ZPER) Study: Puerto Rico, 2016–2018

	Phase 1	Phase 2
Data collection dates	August 28, 2016, to December 3, 2016 (98 days)	November 1, 2017, to December 19, 2017 (43 days)[a]
Participating hospitals	36 hospitals	30 hospitals
Target population	Women who were residents of Puerto Rico and had a live birth during the study period	Women who were residents of Puerto Rico and had a live birth during the study period
Sampling	Island-wide probability sampling stratified by 8 health regions, using hospital-specific sampling schedules to identify eligible women	Island-wide probability sampling, using hospital-specific sampling schedules to identify eligible women and fathers[b]
Eligibility criteria	Live birth on a sampled day in 1 of the participating hospitals, resident of Puerto Rico, and able to complete the survey in English or Spanish	Live birth on a sampled day in 1 of the participating hospitals, resident of Puerto Rico, and able to complete the survey in English or Spanish
Sample size	Women: 2933	Women: 1581 Fathers/partners: 1581
Survey (length/time)	Maternal survey (36 questions/approximately 20 minutes to complete)	Maternal survey (42 questions/approximately 20 minutes to complete) Paternal survey[b] (44 questions/approximately 20 minutes to complete)
Response rate	Maternal survey, 80.6% (n = 2364)	Maternal survey, 94.4% (n = 1492) Paternal survey, 74.6% (n = 1179)
Mode of completion[c]	Paper (28%) or electronic tablet (72%)	Maternal: paper (84%) or tablet (16%) Paternal: paper (87%) or tablet (13%)
Gift for participation	Calendar of baby's first year Crib mosquito net Mosquito repellent (for mothers of deceased infants)	Calendar of baby's first year Crib mosquito net Mosquito repellent (for mothers of deceased infants) Educational component materials (booklets, brochures, notepad, and pen)
Personnel and study support		
Core staff	1 project coordinator	1 project coordinator 1 data manager
Hospital field staff	13 hospital data collectors	11 hospital data collectors 6 regional leaders
In-kind support	Puerto Rico PRAMS Coordinator, Puerto Rico Department of Health Demographic Registry, and Division of Maternal, Child, and Adolescent Health personnel	Puerto Rico PRAMS Coordinator, Puerto Rico Department of Health Demographic Registry, and Division of Maternal, Child, and Adolescent Health personnel

[a]Implementation of the phase 2 in-hospital survey was planned to begin in September 2017. Project implementation was delayed and shortened to 43 days in phase 2 (compared with 98 days in phase 1) because of the loss of infrastructure in the aftermath of Hurricanes Irma (September 7, 2017) and María (September 20, 2017).
[b]The PRAMS-ZPER paternal/partner survey could be completed by the infant's biological father, the mother's same-sex partner, or men who were not the infant's biological father but were identified by the sampled mother as their current partner at the time of the in-hospital survey.
[c]During phase 2, in-hospital surveys were mainly self-administered on paper because of delays in the availability of the tablets; the electronic tablet mode was made available to respondents several weeks after data collection started.

the active transmission of Zika in Puerto Rico. Between 2016 and 2017, nearly 4000 pregnant women were reported to have Zika,[1] which can cause microcephaly and other birth defects in infants born to women infected during pregnancy.[2] Thus, there was an urgent need to gather information on Zika-related experiences and behaviors during pregnancy. Although PRDH declared the end of the Zika outbreak in June 2017,[3] Zika surveillance continued, administrative orders remained in place for continued testing of pregnant women,[4] and use of protective measures were still recommended during pregnancy. Phase 2 allowed continued assessment of maternal behaviors and added the paternal perspective. Implementation of the telephone follow-up surveys provided an opportunity to address new data needs as the outbreak progressed while also allowing assessment of

TABLE 2— Study Methodology, Outcomes, and Resources for the Telephone Follow-Up Surveys of the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response (PRAMS-ZPER) Study: Puerto Rico, 2016–2018

	Phase 1	Phase 2
Data collection dates[a]	May 16, 2017, to July 12, 2017 (58 days)	February 12, 2018, to April 2, 2018 (50 days)
Data collection mode	Phone only	Phone only
Sampling	Proportional random sample of in-hospital survey respondents with a positive match to Demographic Registry's birth certificate data AND all women with evidence of Zika virus infection during pregnancy (i.e., self-reported on phase 1 hospital survey or indicated on infant's birth certificate)	All respondents to the maternal in-hospital survey with a positive match to Demographic Registry's birth certificate data
Sample	Women: 1535	Women: 1485
Survey (length/time)	Maternal survey (37 questions/approximately 20 minutes to complete)	Maternal survey (49 questions/approximately 30 minutes to complete)
Response rate	76.6% (n = 1176)	82.8% (n = 1230)
Gift for participation	Packet with condoms, mosquito repellent, and educational materials	Packet with condoms, mosquito repellent, and educational materials
Personnel and study support: telephone interviewers	6 telephone interviewers	6 telephone interviewers

[a]The telephone follow-up surveys gathered supplemental data to address emerging data needs identified as the Zika outbreak progressed. The phase 1 telephone follow-up survey was implemented approximately 9 months after birth because of time needed to identify gaps, develop surveys and protocols, and obtain necessary approvals. Streamlining of methods during phase 2 allowed for implementation of the telephone follow-up survey approximately 3 months after birth.

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maternal and infant postpartum health and behaviors that could not be assessed at the time of delivery.

The landfall of Hurricanes Irma and María posed new challenges to pregnant and postpartum women. The PRAMS-ZPER study was in a unique position to collect data about experiences in the aftermath of the disaster and was leveraged for that purpose by including hurricane-related questions. The in-hospital data collection also allowed PRDH to incorporate an educational component to reinforce public health messaging for postpartum women and families.

IMPLEMENTATION

Data from Puerto Rico's Demographic Registry were used to identify hospitals. Sampling hospitals were selected based on the number of births during the previous year. Hospitals with 100 or more births in 2015 were eligible for participation during phase 1, and hospitals with 100 or more births in 2016 were eligible for participation during phase 2. PRDH contacted selected hospitals to complete the study's participation agreement. In phase 1, all 36 eligible hospitals participated, representing 99.8% of live births on the island during the sampling period. In phase 2, 30 of 34 eligible hospitals participated, representing 94.2% of births. For this phase, one hospital declined participation, and three hospitals were not included because their maternity wards were closed after Hurricane María.

For phase 1, the sampling design was stratified by the island's eight health regions. Regional oversampling was not performed for phase 2 because of the shortened data collection timeframe after the hurricanes (Table 1). For both phases, probability sampling was used to identify the sampling days in each hospital. All eligible women with a live birth on sampled days were invited to participate.

For phase 1, study personnel approached women 24 or 36 hours after vaginal or cesarean section delivery, respectively. Approximately 220 women were identified to have been discharged before they could be invited to participate. For phase 2, women were approached soon after delivery because of the likelihood of early discharge (e.g., < 24 hours) after the hurricane. For phase 2, we were unable to assess the number of women who were discharged before being contacted by study personnel. In-hospital surveys were self-administered on paper or electronic tablets, with most (72.0%) completed on tablets during

phase 1. For phase 2, most (84.0%) surveys were completed on paper because of delays in tablet availability. For the paternal survey, fathers were approached soon after the birth and before maternal discharge. For all surveys, respondents received a small gift for their participation (Table 1 and 2). Respondents' characteristics are shown in Table A (available as a supplement to the online version of this article at http://www.ajph.org).

After completing the in-hospital survey in phase 2, participants were offered the educational component, which included a 30-minute interactive flip-chart presentation addressing postpartum health, newborn care, and Zika prevention. Supplemental educational materials on breastfeeding, infant care, postpartum care, and mental health, and CDC's Developmental Milestones booklet were integrated into the presentation. A notepad and pen were provided to participants to write down any questions that the study staff were unable to answer, for later follow-up with hospital staff.

After completing the in-hospital data collection, PRDH performed a deterministic linkage of sampled mothers to birth certificate records. Among respondents, linkage rates were 99.4% and 99.5% for phase 1 and 2, respectively. Linkage to birth certificate data provided contact information for telephone follow-up and allowed inclusion of select birth certificate variables (Table B, available as a supplement to the online version of this article at http://www.ajph.org) in analytic data sets. Birth certificate data were also used for data weighting. Data were weighted for stratified sampling design and to adjust for differential nonresponse. The standard PRAMS protocol procedures[5] were followed for the telephone follow-up surveys.

EVALUATION

Maternal response rates were 80.6% and 94.4% for the in-hospital surveys (Table 1) and 76.6% and 82.8% for the telephone follow-up surveys for phase 1 and 2, respectively (Table 2). A response rate of 74.6% was obtained for the paternal survey (Table 1).

Dissemination efforts included a conference for health care professionals, data analysis training, and development of fact sheets and journal articles. Published findings have highlighted topics ranging from the use of Zika prevention measures during pregnancy[6–8] to assessing men's health and involvement during pregnancy.[9] Findings have informed PRDH activities, such as home-visiting and nurse-visiting programs. In addition, data have guided the development of educational and health promotion materials (e.g., provider's role in Zika prevention, maternal use of protective measures, and hurricane preparedness).[10,11]

PRAMS-ZPER study data will continue to be used to assess the effectiveness and reach of Zika emergency response activities, including implementation of clinical testing guidelines,[4] efforts to increase contraceptive use, and receipt of Zika-related screenings for infants.

ADVERSE EFFECTS

We have no adverse effects to report.

SUSTAINABILITY

Implementing the PRAMS-ZPER study during two types of public health emergencies (infectious disease outbreak and natural disaster) was labor-intensive and logistically challenging because of evolving data needs and operational limitations. During phase 2, it was necessary to rapidly adapt questionnaires, protocols, and implementation guidelines after the hurricanes. However, phase 2 response rates exceeded the already high rates obtained in phase 1 by decreasing the length of the data collection period, removing wait-time requirements for contacting mothers, providing extensive interviewer training, implementing a feasibility pilot study, including staff in project planning, and maintaining strong collaboration with partners (e.g., hospitals, Demographic Registry), and PRDH staff resilience.

PUBLIC HEALTH SIGNIFICANCE

Pregnant women and infants are at increased risk for adverse health outcomes during public health emergencies because of their unique health care and resource needs.[12] Given the impact of recent public health emergencies (e.g., Zika, natural disasters, COVID-19) on maternal and infant health and receipt of health services, establishment of new data collection mechanisms or modification of existing surveillance systems for health assessments must be done rapidly. PRAMS-ZPER study operations can be adopted by other state, local, or territorial public health departments as part of emergency preparedness planning. PRAMS-ZPER study protocols, questionnaires, data request guidance, and materials are publicly available on the PRAMS Web site[11] and may be adapted for surveillance studies examining maternal and infant health. AJPH

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Note. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the CDC, the CDC Foundation, or the Puerto Rico Department of Health.

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PUBLICATION INFORMATION

Full Citation: Salvesen von Essen B, D'Angelo DV, Shulman HB, et al. Rapid population-based surveillance of prenatal and postpartum experiences during public health emergencies, Puerto Rico, 2016–2018. *Am J Public Health.* 2022;112(4): 574–578.

Acceptance Date: December 16, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306687

CONTRIBUTORS

B. Salvesen von Essen, D. V. D'Angelo, K. Kortsmit, and L. Warner drafted the article and analyzed the data. H. B. Shulman, W. Hernández Virella, B. Ríos Herrera, P. García Díaz, A. Taraporewalla, L. Harrison, and M. Vargas Bernal provided significant revisions.

ACKNOWLEDGMENTS

We thank all the personnel in the Division of Maternal, Child, and Adolescent Health and the Demographic Registry in the Puerto Rico Department of Health. We also thank all the participating hospitals and the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response study staff as their participation was instrumental throughout the data collection process. Lastly, we are grateful to all the study participants.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

This study was approved by the institutional review board of the University of Puerto Rico Medical Sciences Campus and the CDC.

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