

AN ABSTRACT OF THE DISSERTATION OF

Holly L. Horan for the degree of Doctor of Philosophy in Applied Anthropology presented on May 31, 2019.

Title: Conceiving A Colony: A Multi-Level Biocultural Analysis of the Maternal Stress-Preterm Birth Nexus in Puerto Rico

Abstract approved:

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This dissertation aims to elicit how a neo-colonial context shapes maternal and infant health (MIH) outcomes by describing how they are socially, politically, historically, and culturally produced. Using a multi-level critical biocultural, medical anthropological research approach, the purpose of this research was to investigate maternal stress in the United States (US) territory/colony of Puerto Rico, and to determine whether, and if so, to what extent prenatal maternal stress (PNMS) contributes to the persistently high rate of preterm birth (PTB) on the island. In Chapter One, the general introduction, I outline the rationale and research plan for studying prenatal maternal stress (PNMS) and gestational age at delivery. Chapter Two focuses on the pilot study which includes semi-structured interviews with MIH experts who revealed structural inequities associated with the island's two primary MIH concerns: the elevated PTB and cesarean section rates. Chapter Three transitions to the beginning of the larger dissertation research project focusing on PNMS and gestational age at delivery. Bringing Puerto Rican mothers voices to the fore, I contextualize PNMS in Puerto Rico during the childbearing year highlighting the

ways in which political-economic precarity shapes the existence and severity of stress experiences within this context. Chapter Four centers on the examination of the impact of the 2016 Zika virus (ZIKV) crisis on Puerto Rican women's experiences of PNMS – focusing on the disconnect between maternal beliefs and health behaviors as pregnant individuals wrestled with the island's reproductive colonial past. Chapter Five is the conclusion of this dissertation, outlining each chapter and connecting the multiple ways in which colonization serves as the most pervasive etiology of PNMS in Puerto Rico. This conclusion ends with a post-script on my reflection of Hurricane Maria and how this natural disaster further exposed structural inequities as well as foreshadows the challenges and potential of future, collaborative MIH research on the island.

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Conceiving A Colony: A Multi-Level Biocultural Analysis of the Maternal Stress-
Preterm Birth Nexus in Puerto Rico

by
Holly L. Horan

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APPROVED:

Major Professor, representing Applied Anthropology

Director of the School of Language, Culture, and Society

Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Holly L. Horan, Author

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CONTRIBUTION OF AUTHORS

Dr. Cheyney serves as my co-author on Chapter Two, working with me in the field to collect and analyze data and assisting me in the writing of the manuscript. Dr.

Cheyney and Eni Nako are my co-authors on Chapter Three. Ms. Nako collected data with me while in the field and began this manuscript to fulfill the requirements for her honor's thesis. Dr. Cheyney is a content expert in the vertical transmission of Zika and advised Ms. Nako and I in the analysis of the findings and the writing of the manuscript.

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Chapter One: General Introduction

In the following five chapters of this dissertation, I nuance the lived experience of maternal stress, pregnancy, and birth outcomes in the United States (US) unincorporated territory of Puerto Rico from the perspective of maternal and infant health (MIH) experts, and mothers. In Chapter One, the general introduction, I outline the and plan for studying prenatal maternal stress (PNMS) and gestational age at delivery from a critical biocultural, medical anthropological perspective. Chapter Two through Chapter Five include in-depth, qualitative, quantitative and ethnographic data describing the complexities of the MIH system and PNMS in Puerto Rico eliciting how the public health crises of the Zika virus (ZIKV) epidemic and Hurricane Maria, reveal the complex relationships between colonial inequities and poor MIH outcomes. Chapter Five is the conclusion of this dissertation, outlining each chapter and connecting the multiple ways in which colonization serves as the most pervasive etiology of PNMS in Puerto Rico. This conclusion ends with a post-script on my reflection of Hurricane Maria and how this natural disaster further exposed structural inequities as well as foreshadows the challenges and potential of future, collaborative MIH research on the island.

Research Context

Puerto Rico is a Spanish-speaking, mountainous, Caribbean island and one of three US Commonwealths (i.e. unincorporated territories) that has been colonized since the late 15th century (Ayala and Bernabe 2007; Carr 1984; Wagenheim 1975). *Tainos*, a population considered indigenous to the island, were the first to encounter *Cristóbal Colón* in 1493 on his second voyage from Spain to the “New World” (Rouse 1992). *Colón* changed the indigenous name of the island from *Borikén* to *San Juan Bautista* and in the following years of the early 16th century, Spanish colonization led to the enslavement and evangelization the *Taino* people (1992;

Saunders 2005). Africans were also brought to the island at this time, reportedly being smuggled in by the Spanish colonizers to serve as domestic servants (Dietz 1987, Ayala and Bernabe 2007; Carr 1984; Saunders 2005; Wagenheim 1975) – ultimately resulting in the significant degree of African admixture and influence in contemporary Puerto Rican society (Godreau 2015; Tang *et al.* 2007; Via *et al.* 2011). Africans and descendants of the remaining *Taino* people were enslaved as laborers for the next three centuries (Dietz 1987; Núñez Seixas 2013; Saunders 2005). During the Spanish colonial era, the island eventually became known as Puerto Rico (Carr 1984; Saunders 2005; Wagenheim 1975) and was prized by the Spaniards as the “Key of the Indies” (Altman 2017; Rouse 1992; Saunders 2005) – a strategic location for an expanding empire who believed to have the “strongest foothold of Spain in America” (Dietz 1987; Morales Carrión 1983; Wagenheim 1975).

In February of 1898, the American naval ship the *USS Maine*, originally sent to Cuba to protect US interests during the Cuban revolt against Spain, exploded in the Havana Harbor (Ablett 2004; Ayala and Bernabe 2007; Carr 1984; Scarano 2008; Wagenheim 1975). This explosion marks the beginning of the events that led to the declaration of the Spanish-American war in April of 1898 and the US colonial era in Puerto Rico (Brás n.d.; González Valdes 1992; Negroni 1992; Scarano 2008; Trías Monge and Casares 1999). On December 10th, 1898, the *Treaty of Paris* was drafted – with Spain relinquishing almost entirely of what remained of the Spanish Empire to the US, including Puerto Rico, Guam, and the Philippines (Brás n.d.; Pérez 1998; Wolff 2006). Upon ratification of the Treaty of Paris, Puerto Rico was now under US military control (Brás n.d.; González Valdes 1992; Negroni 1992; Scarano 2008; Trías Monge and Casares 1999; Wagenheim 1975).

Over the last 120 years of the US regime, Puerto Rico has endured significant political, economic, and social changes including the shift of currency from the *peso Puertorriqueño* to the US dollar, the establishment a formal education and public health system, the transition from the agricultural industry to monocropping and eventually to large-scale industrialization, the inclusion of Puerto Ricans in the US military service, and the establishment of English as the official second language of the island (Ayala and Bernabe 2007; Carr 1984; Lewis 1966; Mintz 1974; Wagenheim 1975). While significant improvements in basic public health infrastructure and education levels resulted in the first half of the 20th century, Puerto Rico experienced significant economic strife in the 1970s and 1980s – ultimately causing local authorities to enact the Internal Revenue Service (IRS) Section 936 corporate incentives, exempting American corporations from paying federal income tax on profits earned with Puerto Rican manufacturing subsidies (Ayala and Bernabe 2007; Carr 1984; Collins *et al.* 2006; Grosfoguel 2003; Wagenheim 1975). The shifting economy, as a result of colonialization, is characteristic of the contemporary Puerto Rican landscape as the island continues to struggle to absorb the labor force displaced by previous economic initiatives (Ayala and Bernabe 2007; Collins *et al.* 2006; Grosfoguel 2003; Whalen 2001).

Until 2017, the Puerto Rican economy survived on tourism and is a leading pharmaceutical, manufacturing, and financial center for the US and the Caribbean (Collado Schwarz 2012; Collins *et al.* 2006; Dietrich 2013; Grosfoguel 2003; Whalen 2001). Since the early 2010's, Puerto Rico's debt crisis has been gaining publicity – an issue that had been growing steadily since 1973 (Pantojas-García 2016; Whiteside 2018). To address this deficit the US government issued bonds instead of readjusting Puerto Rico's budget – a practice that continued until 2014 (Atilas-Osoria 2016; Pantojas-García 2016; Whiteside 2018). In 2016,

Puerto Rico's bonds were downgraded when the Puerto Rican government indicated that it was unable to pay its staggering 72-billion-dollar debt (Pantojas-García 2016; Whiteside 2018). In response, the US Congress enacted the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA), an appointed board and official oversight of Puerto Rico's budget – better known locally as *La Junta de Control Fiscal* (Atilés-Osoria 2016; Joffe 2016; Pantojas-García 2016; Whiteside 2018). In response, the Puerto Rican government planned to bolster the economic crisis by increasing taxes and decreasing public services and worker's benefits – resulting in one of the biggest uprisings from the Puerto Rican left in a protest called *la Milla de Oro* - an area that spans a one-mile stretch of the financial district in *Hato Rey*.

The late summer of 2017 hurricanes of Irma and Maria only exacerbated existing socio-political and economic strife on the island, destroying the island's infrastructure. All 3.4 million citizens lost access to electricity and potable water as a result of these storms. It has also been estimated that up to 5,000 or more lives were lost as a result of the hurricane and its devastating aftermath (Kishore *et al.* 2018; Santos-Lozada and Howard 2018; Zorrilla 2017). In the days following the hurricane, Puerto Rican governor *Ricardo Rosselló* announced that damages to the island were estimated to be in the billions and that over 80 percent of the island's agricultural lands were lost resulting in estimated agricultural losses of \$780 million (Robles and Ferré-Sadurní 2017) Since this time, the island has been in a state of slow and uncertain re-growth.

Preterm Birth in a US Colony

Preterm birth (PTB) is a major health concern in Puerto Rico today, as the rate has nearly doubled since 1990. Defined as a live birth before 37 weeks gestation, globally, there are an estimated 15 million infants born preterm each year (WHO 2018). Complications associated with early delivery is a leading cause of death among children under five years of age, and is

associated with life-long, chronic health issues for children who survive (2018). It is also estimated that nearly three-quarters of these death could have been prevented with “cost-effective interventions”. The PTB rates of the top 10 most affected countries ranges from 15.4 to 18.1 percent (2018); Puerto Rico’s rate of 11.4 percent gives the island a “D” on the annual March of Dimes (MOD) scorecard (MOD 2019a) - more than two percent greater than the rate in the continental US of 9.9 percent (Cordero 2013; MOD 2019b; Puerto Rico Testsite for Exploring Contaminate Threats (PROTECT) 2017; The World Bank 2018). Both rates for the US and Puerto Rico are shockingly high, as 98 billion dollars are spent annually on maternity care in the US (Amnesty International 2011), with 26.2 billion of those funds dedicated to treating the consequences of preterm birth (Institute of Medicine (IOM) 2006).

Though a high priority area for research in the US, risk factors for PTB have remained elusive in some populations. Puerto Rico’s PTB rate has declined since 2006 from 19.9 percent to its current rate as a result of MIH advocacy on the island to reduce early elective inductionsⁱ prior to 39 weeks gestation (PROTECT 2017) however the rate remains persistently and inexplicably high. In a recent investigation of Puerto Rico’s PTB rate, Cordero (2013) failed to identify statistically significant associations between any of the “usual suspects” commonly correlated with high rates of PTB in the US including: access to prenatal care in the first trimester, maternal education, health insurance, mode of delivery (vaginal vs. cesarean), maternal age, multiple gestations, and tobacco use. This dissertation, with its emphasis on perceived maternal stress (PNMS), will allow for an investigation of aspects of pregnancy and birth in Puerto Rico that are missing in the Cordero (2013) study—information that may be essential to understanding the contextually unique aspects of PTB on the island.

Studies of maternal stress and birth outcomes in anthropology have focused primarily on the effects of racial/ethnic discrimination, objective vulnerability versus subjective stress, malnutrition, maternal deprivation, and the role of the maternal hypothalamic pituitary adrenal axis (HPA) during pregnancy (Farewell *et al.* 2018; Gravlee 2009; Jasienzka 2009; Kuzawa 2005; 2008; Kuzawa and Sweet 2009; McDade 2009; Stinson 2012; Thayer and Kuzawa 2015). Scholars of perinatal stress have widely argued that any study of the association between PNMS and birth outcomes requires a deeper, more holistic understanding of the ways maternal stress is experienced within unique and highly dynamic individual, socio-historical, political-economic and biological contexts. Social epidemiologists and medical anthropologists have, in response to such findings, argued for a multi-level analysis of discrimination and oppression, asserting that, “at the individual level, the experience of unfair treatment or interpersonal discrimination has a wide range of embodied consequences” (Gravlee 2009:52). These consequences include, but are not limited to, increased rates of poor birth outcomes such as PTB (Dole *et al.* 2004; Gravlee 2009; Mustillo *et al.* 2004).

Theoretical Frameworks

Critical Biocultural Anthropology

This dissertation provides an anthropological foundation for addressing methodological and theoretical gaps in the PNMS and PTB literature through the application of critical biocultural (CBC) and critical medical anthropological (CMA) frameworks. With these guiding theoretical lenses, I explore how PNMS, in the context of a US colony, may influence gestational age at delivery. Leatherman and Goodman (2011) use a CBC framework to explain how culture creates *biologies*, arguing that human biology and health are inherently socio-cultural and that existing biocultural research inadequately addresses how large-scale political and economic

processes “get under the skin”. The challenge of the CBC framework begins with the arguably elusive notion of “culture”, indicating the need to make the culture concept both explicit and central to all biocultural analyses. I use a CBC approach to conduct a multilevel analysis of how Puerto Rican culture is (or is not) associated with the island’s prevalence of PTB without conflating birth outcomes with other social attributes specific to this context.

This CBC approach is informed by Farmer (2005) who has argued that culture has sometimes been used as a decoy in anthropology, inadvertently deflecting attention away from insidious power asymmetries and masking exploitation as “cultural difference”. In the following chapters, I aim to identify salient components of Puerto Rican culture as described by participants as stress producing or ameliorating, while critically assessing “cultural components” that may also be understood through the lenses of power and inequality. This approach will allow me to adequately portray Puerto Rican culture and context while also paying close attention to power and power inequities, understanding that “culture” often does not explain suffering; in Farmer’s words, “it may, at worst furnish an alibi” (2005:48-49).

Lindenbaum and Lock’s (1993) notion of *local biologies* emphasizes interactions between the social and the biological and is premised on disrupting the naturalized divide between nature and culture that they argue is embedded in modernist thinking. Local biologies “refers to the way in which the embodied experience of physical sensations, including those of well-being, health, and so on, are in part informed by the material body, itself contingent on evolutionary, environmental, and individual variables”; where the biological and the social being are “coproduced and dialectically reproduced” (Lock *et al.* 2000:484). Local biologies originates from the rich traditions in anthropology that examine how culture, an integral component of the human experience, influences the subjective experience and individual performance of illness

(Good 1993; Kleinman 1982; Lindenbaum and Lock 1993; Masquelier 1997). Lock and Nyugen (2010) argue that the medicalization of the body, with the spread of biomedicine, has manifested in various forms specific to cultural and political-economic contexts. While pregnancy is arguably not an illness for most women, it has been heavily medicalized within modern US-style obstetrics (Cheyney 2011; Davis-Floyd 2004; Neiterman 2012), and thus, through participants' narratives, I describe how discussions of stress during pregnancy often fit within pregnancy-as-disease models as well as within the historical and shifting cultural expectations of pregnancy, birth, and motherhood in to Puerto Rico.

In addition to nuancing the experiences of stress and pregnancy in the Puerto Rican context, I complicate the roles of race, racism and the emic designator *color* in health outcomes while simultaneously exploring the ways large scale socio-political and economic changes differentially affect local biologies and birth outcomes. Race, the social construction of human difference based primarily on skin color, becomes biology through discourses and practice (Leatherman and Goodman 2011). Yet, Goodman and Leatherman (1998) have argued that most measures of racism commonly employed in epidemiological studies focus on interpersonal aggressions and prejudice, disregarding or overlooking connections to historical and structural features of racism and the roles these play in the production of health inequities. The circumstances in Puerto Rico are even more complex as Puerto Ricans do not rely primarily on "race" for social classification, instead, they use the emic concept of *color* where, "...classification is shaped not only by skin color but also by other physical features, and possibly, by social status markers like wealth, family background or residential area" (Gravlee, Dressler, and Bernard 2005:2191). In order to explore maternal stress perception and the potential effects of this stress on the local biologies of PTB within a voluntary sample of Puerto

Rican women, this dissertation project included a multi-level, woman-centered approach that sought to uncover the nuanced, subjective experiences of PNMS and demographic measures of race and *color* in tandem with the measurement of chronic cortisol release as reflected in hair samples, interpreted against the ethnographic and political-economic backdrops of past and present US colonial domination.

Critical Medical Anthropology

I have also employed critical medical anthropologist Merrill Singer's (2009) concept of *syndemics* (a combined term from "synergistic" and "epidemics") to examine the various individual-, community-, and institutional-level factors that influence women's experiences of PNMS, the consequences of this stress for pregnancies, and the clustering of poor birth outcomes like PTB in Puerto Rico. The concept of syndemics was developed to elaborate on the multiple "vertical linkages" (Singer *et al.* 2011) that connect social groups or behaviors to larger political and economic systems as they function to shape disease processes and health outcomes. The concept of syndemics examines the development and existence of "disease concentrations" (i.e. multiple co-morbid diseases or disorders) with "disease interactions" (the way diseases/disorders impact the health consequences of other diseases/disorders). Human environments, including social relationships, institutionalized inequality, and injustice contribute significantly to disease clustering, their spread and interaction, and co-morbidities—countering the one-disease, one-treatment biomedical approach (Mendenhall 2012; Singer *et al.* 2011; Singer *et al.* 2017). Though PNMS and PTB are not "diseases" – they are conditions that carry considerable psychological and physiological health consequences that span the life-course (Gravlee 2009; Krieger *et al.* 2005; 2010; Kuzawa and Sweet 2009; Lende 2012).

Research Objectives and Design

Pilot Study (July – August 2014)

In the summer of 2014, my advisor, myself and two research assistants conducted a preliminary study with MIH care providers in San Juan, Puerto Rico. This study was designed to explore the institutional and political-economic factors associated with poor MIH outcomes, such as PTB. We collected 20 in-depth, semi-structured interviews with MIH experts, asking them to describe what they believed were the primary issues associated with, and barriers to, improving MIH outcomes in Puerto Rico. Expert interviews included midwives (*parteras*), obstetricians, pediatricians, perinatal psychologists, a lactation consultant, a labor and delivery obstetric nurse, and public health professionals, all of whom work in San Juan and the surrounding metropolitan area. Key themes based on participant narratives indicated that the high PTB and nulliparous, singleton, term, vertex (NSTV) cesarean birth rates were the primary MIH concerns on the island – describing several institutional and everyday stressors that contributed to these poor birth outcomes. We have since developed on-going, collaborative relationships with midwives, obstetricians, pediatricians, perinatal psychologists, and academics in Puerto Rico who engaged in an iterative process of research design as we developed the larger dissertation research project.

PNMS and PTB Investigation (August 2016 – March 2018)

The purpose of this research was to investigate the biocultural production of maternal stress in a US territory/colony, and to determine whether, and if so, to what extent maternal stress contributes to the high rate of preterm birth in Puerto Rico. Four specific objectives guided this project:

- O₁: Identify Cultural Models of Maternal Stress and Pregnancy: To elicit cultural models of maternal stress and pregnancy from a diverse, voluntary sample of pregnant

women in Puerto Rico and to use these findings to add culturally specific questions to two previously validated stress scales.

O₂: Quantify General and Pregnancy-Specific Perceived Maternal Stress: To collect data on the subjective, pregnancy-specific and non-specific perceived stress experiences in a diverse, voluntary sample of pregnant women in Puerto Rico using two refined and validated stress scales.

O₃: Examine Relationships between Perceived Maternal Stress and HCCs: To test the independent effect(s) of subjective, pregnancy-specific and non-specific perceived stress experiences on maternal HCCs in a diverse, voluntary sample of pregnant women in Puerto Rico.

O₄: Examine Relationships between Perceived Maternal Stress, HCCs, and Gestational Age at Birth: To test the independent effect(s) of subjective, pregnancy-specific and non-specific perceived stress experiences and HCCs on gestational age at delivery in a diverse, voluntary sample of pregnant women in Puerto Rico.

Constructed as a two-phase, mixed-methods ethnographic study, four core research activities were central to this investigation: 1) in-depth participant-observation in Puerto Rican maternal and infant healthcare centers and non-profit or community-based organizations; 2) conducting semi-structured interviews about pregnancy-specific and non-specific stressors experienced by pregnant or recently postpartum Puerto Rican women (n=25); 3) assessing the degree to which participants' experiences of stress, as measured using two validated and locally-tailored stress assessment tools, predict HCC levels by each trimester and postpartum (n=86); and 4) estimating the effects of perceived stress and HCCs on gestational age at delivery (n=52).

Institutional Review Board (IRB) approval for this project was received from Oregon State University in April of 2016.

Does maternal stress impact gestational age at delivery in pregnant Puerto Rican women? In order to generate an emically valid understanding of stress, its etiologies, and associated risk factors that are relevant to study participants, I employed the use of semi-structured interviews and structured surveys, as well as biomarker measures across the childbearing year (first trimester through six to eight weeks postpartum). With the use of these methodologies, the specific goals of this mixed-methods study are: a) to identify a cultural model(s) of maternal stress in pregnant women; b) to measure perceived maternal stress during gestation using two locally tailored and validated stress surveys; c) to test the effect of perceived stress on maternal cortisol using hair sampling; and d) to determine whether, and if so, how perceived stress and cortisol secretion over the course of pregnancy is associated with gestational age at delivery. The three following hypotheses were specified in advance:

H₁: Puerto Rican women will describe a range of pregnancy-specific and non-specific stressors. Experience of these stressors will vary due to Puerto Rico's unique political-economic context as a non-incorporated US territory and by social variables such as educational level, marital status, socio-economic status, parity, perceptions of social and familial support, ease of access to maternity care, model of care (midwifery versus obstetric), history of obstetric complications, and the social construction of color (Gravlee, Bernard, and Dressler 2005).

H₂: Maternal stress, as measured by two validated surveys, will correlate with maternal self-reports of perceived stress and HCCs collected by trimester and at four to eight-weeks postpartum.

H₃: Participants with the highest subjective experiences of stress as captured by two validated surveys and with the highest HCCs will be have shorter gestations. That is, there will be a dose-dependent relationship between maternal stress (both subjective and physiologic) and length of pregnancy where high stress is correlated with shorter gestation, after controlling for confounding variables.

Phase I of this project focused on contextualizing PNMS in the Puerto Rican context. The participant population included a voluntary sample pregnant and or recently postpartum women (N=25), over the age of 17, that had received their prenatal care and intended to deliver their child in Puerto Rico. Mothers were recruited through a community-based maternal and infant health center and at a hospital-based lactation support group, both located in neighboring *municipios* that constituted the San Juan metropolitan area. At the community-based organization, we (myself and the research assistant) would attend the weekly clinical day, talking with clients (i.e. moms and their families) about our study and often conducting interview on the same day with interested individuals. Wait-times at the community-based clinic were often long, up to three or four hours, allowing the mothers plenty of time to learn about the study, provide voluntary, verbal consent and complete an interview. For the lactation support group, we attended the weekly support group meetings at the hospital (or sometimes at popular coffee shops in the metropolitan area). The support group leader, a local and well-known pediatrician, gave us the opportunity to share information about our study at the beginning of each meeting. After two weeks of rapport building with mothers at the support group, they began to approach us about participating in the study.

This initial phase of interviewing included unstructured and semi-structured interview techniques (Bernard 2011), with the intended goal to gain a specific understanding of how stress

is perceived and experienced by pregnant Puerto Rican women. The research assistant and I encouraged participants to describe, in their own terms, some of daily pregnancy-specific and non-specific stressors they experienced, as well as the ways they attempt to manage or mitigate stress. This information allowed for the construction of cultural models of prenatal stress in Puerto Rico and for the discovery of additional concepts that were formulated into questions and included in the two stress surveys, ensuring that these measures were culturally relevant. All interviews were audio recorded with the consent of the participant. Demographic and health information about the mother was obtained at the time of enrollment after the participant consented to the study and included information about various demographic, social, and clinical factors including socioeconomic status, maternal education level, insurance coverage, color, smoking, body mass index (BMI) and parity.

Phase II of this project focused on the relationship between perceived maternal stress and birth outcomes and was known as the “clinical phase”. The subject population consisted of a voluntary sample (n=88) of pregnant Puerto Rican women (and their fetus/infant) receiving prenatal care at a high-volume obstetric hospital in Cayey and at its satellite office in Cidraⁱⁱ. Cayey and Cidra are a 40 to 60-minute drive south of the capital city of San Juan and a 20-minute drive between the two cities themselves. Both cities can be characterized as a mountain municipality that provides medical services for rural and urban communities in the surrounding *municipios* in the mountainous, central region of Puerto Rico. Participants had to be at least 18 years of age at the onset of their participation in the study and no older than 40 years of age at the time of birth. Infant participants, as a result of the pregnancy, were required to be the most recently born child of the mother who was enrolled this phase of the study.

In addition to completing the eligibility screen described in phase I, two tasks, measuring general- and pregnancy-specific stress: 1) the Cohen Perceived Stress Scale; and 2) the Revised Prenatal Distress Questionnaire. The first task was to assess the general perceived stress of a pregnant woman over the last month at three specific periods during pregnancy, representing each trimester: first trimester, 22 to 24 weeks, and 34 to 36 weeks. The PSS format used for this study was the 10 question, Puerto Rican PSS scale (10-PSS) which uses a five-point, Likert scale to assess how often an individual thought or felt a certain way over the last month, ranging from “never” to “very often”. The second task was to assess acute, in-the-moment, pregnancy-specific perceived stress. This included a translated, Spanish version of the 12 question, RPDQ. The RPDQ uses a five-point, Likert scale to assess how often certain aspects of pregnancy are uncomfortable or upsetting to a woman, ranging from “not at all” to “extremely”. With these surveys and the additional questions developed based on data gathered in the phase I interviews (n=25), we planned to assess the utility of these scales as culturally relevant measures of general and pregnancy-specific stress for pregnant women in Puerto Rico. The results of these tasks provide (a) validity check for the of the PSS and RPDQ scales in this population, (b) provide a measure of general and pregnancy-specific perceived stress, and (c) determine a measure of agreement of general and pregnancy-specific perceived stress among the participants (Dressler *et al.* 2005; Glynn *et al.* 2008; Ice and James 2007; Worthman 2010).

In addition to the two stress scales, participants were also asked to provide hair cortisol samples each trimester (visits one through three) and at the final postpartum visit (the fourth and final visit). During each visit myself and/or a research assistant (with my oversight) collected a one-inch by one-inch region of participant’s hair from the posterior vertex region of the mother’s head, first securing the hair with a small rubber band and then cutting the hair sample as close as

possible to the participant's scalp. The sample was then measured, marking the scalp end and cut to approximately four centimeters (cm) (Stalder and Krischbaum 2012). Repeat measures were taken from the same site in the back of the head at the second, third, and fourth visits. At the postpartum visits that occurred before Hurricane Maria, we asked to collect both a maternal and a newborn infant hair sampleⁱⁱⁱ. The mother provided consent for the infant hair sampling and was given the opportunity to cut the hair sample^{iv} themselves during the postpartum visit. All participants who completed their postpartum interviews after Hurricane Maria were outside of the four to eight-week postpartum timeframe and thus, we were unable to collect biomarker data during the final visits after the storm.

At the fourth visit, postpartum exit interviews were conducted with participants (N=37). Prior to Hurricane Maria, we planned to complete the final, postpartum visit four to eight weeks after birth and at that time, I had completed only 10 final visits with participants. Once local partners deemed it safe for me to return to the island, we (two research assistants and I) completed the remaining 27 postpartum interviews either by phone or in-person. Exit interviews were structured to ask participants to reflect on their pregnancy, birth and postpartum experiences before and after Hurricane Maria (Bernard 2011; Spradley 1979) and to elaborate on specific stress experiences noted in their responses to the two stress scales. Participants were also invited to reflect on the experience of pregnancy overall. This approach allowed us to nuance their perceptions of stress and to describe how the outcome(s) of their experiences related to their daily, lived-experiences, the greater social and political-economic circumstances of a US colony and/or to unusually stressful events that may have occurred during their pregnancy such as *la Junta*, the ZIKV crisis, or Hurricane Maria. Participants were encouraged to express themselves

in their own terms and to determine the pace of the interview. All interviews were audio recorded with the verbal consent from each participant.

In addition to qualitative reflections on participants' pregnancy and childbirth experiences, we also collected closed-ended data points on six patient reported birth outcome variables (n=44) during the exit interviews and/or in scheduling interviews during our participant-relocation efforts following Hurricane Maria. Patient reported variables included: 1) estimated due date and how it was measured, 2) birth date of infant, 3) birth weight of infant, 4) sex of infant, 5) mode of delivery, and 6) gestational age at delivery – all of which have been shown to be reliably reported by patients. This allowed us to avoid having to access the participants' medical record as patient reported outcomes have been shown to be a reliable method of data collection and comparable in accuracy to the use of medical records (Ekouevi and Morgan 1991; Ellison *et al.* 2000; Gayle *et al.* 1988; Little 1986; Sanderson *et al.* 1998). Patient reported outcomes are shared as preliminary, descriptive statistics in this dissertation with plans to integrate this data into a larger statistical analysis to better understand how perceived maternal stress, hair cortisol concentrations, and operationalized variables from the postpartum exit interviews can be used to better understand the relationship between PNMS and gestational age at delivery.

Participant observation, the primary method of data collection for this project, is an iterative process used to identify important scenarios and conditions of maternal stress – particularly as they relate to the political and economic context of a US colony. This method allowed for the creation of a systematic record of day-to-day interactions, observations, and informal conversations through field notes (Bernard 2011), extending the internal and external validity of this study by helping me understand the localized meaning of noted observations

(2011). Participant observation occurred primarily through my time spent collaborating, living and volunteering at a Puerto Rican community MIH center that focused on the provision of midwifery and doula services across the childbearing year.

During 12 months of this fieldwork, I lived at the community MIH center (from October 1st, 2016 – September 27th, 2017) where I had the opportunity to attend dozens of events and classes, including childbirth preparation classes, doula trainings, breastfeeding support groups, well-baby assessments, and group meetings. Per invitation of a local midwife and key informant, I enrolled in a *pre-parteria* (midwifery) training with other prospective *parteria* students and attended prenatal visits, births, and postpartum visits as a doula and *una asistente de partería* as well as completed intake for prenatal clients during the weekend clinic days. My family and I also cooked in the kitchen and ran a small café on the weekend clinic days to support the center. These dynamic and in-depth interactions, in addition to attending the hospital-based lactation support groups, allowed for the opportunity to observe and build relationships with expecting mothers, their support systems, and maternal and infant health care educators and providers, gaining multi-level insight into the individual, family, community, and institutional-level factors associated with pregnancy and birth as they are experienced and performed in Puerto Rico. In phase II, due to the culture of physician waiting rooms, I was also able to conduct participant observation in the lobby, hallways, waiting rooms, and break rooms of the clinical sites at various points during this phase of this study – a necessary juxtaposition to the experiences at the community MIH center that serves only a small fraction of pregnant individuals on the island.

Methodological Innovation

This project was methodologically innovative in three ways. First, based on insight from participant narratives in phase I, we constructed a culturally valid stress measure without

affecting the integrity of existing, validated stress scales employed in phase II. Due to its reciprocal ethnographic methodological design, this project also presents the potential opportunity to develop a new, culturally relevant stress scale unique to the Puerto Rican context (Lassiter 2005). Exploratory interviews in phase I allowed participants to elaborate on their experiences of stress, enabling us to assess how and to what degree the interpersonal, political-economic, and institutional messages about pregnancy and birthing in Puerto Rico serve as a source of stress or support for women. The specific questions used in these interviews were informed by our preliminary study, and we relied primarily on open-ended questioning to maximize our chances of capturing maternal stressors unique to Puerto Rico – ultimately providing us with a better understanding of how PNMS functions and fluctuates during pregnancy and how stress may be related to individual, social, and political-economic factors.

The second way this research project is innovative is that it allowed for triangulation of multiple stress measures over time, including one-month, three-month, and nine-month measures that utilize both qualitative and quantitative methodologies in the form of surveys (acute and one-month), hair cortisol measures (three months), and postpartum semi-structured interviews (nine months). The third reason this project is innovative is because of its use of a long-term, cortisol measure in CBC medical anthropological research project, included at each visit with participants in phase II, as described above. To date, this project is the largest study of PNMS that includes hair cortisol measures across the childbearing year.

Project Significance

Intellectual Merit

This project has six primary contributions intellectual merit as the focus on perceived and physiological measures of maternal stress have allowed for a description of how women produce

and embody institutional expectations of pregnancy and motherhood as they are shaped and situated within a US colony. The first strength of this project is that it will advance hair cortisol measurement methods allowing for the assessment of perceived maternal stress and its potential relationship to gestational age at delivery within a cultural, political-economic and ethnographic context (Glynn *et al.* 2008). Secondly, this project aims to advance knowledge about the utility of measuring pregnant women's subjective, pregnancy-specific and non-specific perceived stress experiences. With this information, I may be able to elucidate how perceptions of stress, models of care (midwifery, obstetric, group care, etc.) as well as familial and larger social support networks (i.e. civil organizations, such as our local partnering non-profits, empowering women) exacerbate and/or mediate perceived stress in pregnancy.

The third strength of this project is that it will allow us to examine the validity of HCC measurement as a physiological correlate of subjective, pregnancy-specific and non-specific perceived stress experiences. The fourth strength of this project is that findings will enable myself and fellow co-authors and colleagues to examine the effect(s) of subjective, pregnancy-specific and non-specific perceived stress experiences and HCCs on gestational age at delivery—a potential relationship that could revolutionize the ways researchers and clinicians understand, measure, and attempt to reduce maternal stress and any associated preterm birth risk. Finally, the findings from this proposed research project have the potential to advance CBC and CMA theories and to contribute to theory building more specifically around local biologies and syndemics as these relate to US colonial contexts and health, maternal stress, pregnancy, motherhood among women of color, and poor birth outcomes (Gravlee 2009; Lindenbaum and Lock 1993; Lock *et al.* 2000; Singer *et al.* 2011; Thayer and Kuzawa 2015).

Broader Impacts

This study will produce broader impacts in six key areas. First, through the in-depth study of pregnant Puerto Rican women and their perceived stress experiences, their biological stress experiences, and any impacts on gestational age at delivery, this study will contribute to a more comprehensive understanding of the social and structural etiologies associated with maternal stress and poor MIH outcomes in Puerto Rico and, perhaps, beyond. Findings will be disseminated as a one-page, single-sided document, highlighting the study's key findings. This information will be distributed through our community partners through in the form of social media and fliers, as well as through maternal and infant health partners that collaborate with our partners. Thus, the findings of this project have the potential to reach numerous health care providers and public health professionals in Puerto Rico and may be used in educational and advocacy work for Puerto Rican women and their families. Findings may ultimately help reduce poor obstetric outcomes and foster future research collaborations by informing public health programs in Puerto Rico about structural and individual barriers to optimizing perinatal health outcomes. In addition, as research assistant and I have developed results packets for all participants in phase II that includes a simple breakdown of their survey and cortisol results and what they mean. Participants indicated that they were very interested in seeing these results and we hope to refine these documents for content and ethical considerations and plan to share them with all interested participants when I return to the field this fall.

Broader impacts two and three focus on how these findings can inform policy advocates and MIH reform specialists. Due to the potential impact of social media in Puerto Rico, the second broader impact of this research is that these findings (distributed in the same, one-page document mentioned above) will also reach policy advocates and health economists in Puerto Rico, particularly those working within the existing health insurance entities. In addition to our

community-based partners, this information will be shared with partners at the University of Puerto Rico Medical Sciences campus who will distribute findings more widely to relevant programs at *el Departamento de Salud*. Findings may be used to inform public policy aimed at improving social supports for women, infants and children and, furthermore, may be at least partially generalizable to other populations with high PTB rates outside of Puerto Rico. Third, these findings have the potential to inform MIH reform – bolstering the position of more sustainable, holistic models of care such as mother-led care and improving the structural supports of integrated MIH that already exists informally on the island.

The final three broader impacts focus on individual research training and methods. The fourth broader impact focused on the recruitment of female research assistants from Puerto Rico. Three of the four research assistants were either Puerto Rican midwifery students or doulas from one of the partnering community-based organizations. This study provided them a unique opportunity to be employed working on a mixed-methods, anthropological research project. Fifth, due to my desire to be intimately involved in all steps of data analysis, I have been trained in the laboratory analysis of the hair samples, allowing me to gain valuable technical skills, while strengthening institutional ties between Oregon State University and the University of Oregon. Finally, this research contributed to my doctoral training as a *Latinx* doctoral student of Puerto Rican descent who intends to continue to serve the island through research and publications.

Overview of the Manuscript Format

The manuscripts of this dissertation are the beginning of a step-wise process eliciting the utility of specific qualitative and quantitative measures for understanding PNMS and its impact on MIH in Puerto Rico; creating a platform for understanding how the issues plaguing Puerto Rico's health system are the result of colonization, a major contributor to PNMS and poor birth

outcomes. Lead theoretical frameworks in the field of PNMS and birth outcomes research argue for long-term measures of cortisol but pay minimal attention to understanding the series of life events that disrupt allostasis with the potential to cause poor health (Duffy *et al.* 2018; Gunnar and Vazquez 2001; Lobel *et al.* 2008; Sandman and Davis 2012; Szgeda *et al.* 2017; Yehuda *et al.* 2015). Existing systems of oppression influence individual life courses and health in unique ways; however, it is my goal to convey in the following manuscripts the importance of a multi-level approach that highlights the individual experiences of those at the center of this research, mothers and babies.

Chapter Two focuses on the pilot study and includes in-depth qualitative data from MIH experts about the Puerto Rican health system and how it impacts MIH outcomes. This chapter begins by outlining the existing state of the health care system – highlighting deficits that are unique to this context that potentially contribute to PTB. This overview is followed by the voices of Puerto Rican MIH experts who identify, in their opinion, the greatest MIH issues on the island, the existing barriers to improving these health issues, and potential solutions to creating a more sustainable, quality maternity care system on the island. Co-author Dr. Melissa Cheyney and I shape our understanding of the relationship between the Puerto Rican health care system and poor birth outcomes by proposing a *syndemic of poor MIH outcomes* that draws attention to the direct and indirect consequences of colonization that are pervasive in Puerto Rican's lives.

Chapter Three transitions to the beginning of the larger dissertation research project focusing on PNMS and gestational age at delivery, bringing Puerto Rican mothers voices to the fore. Here, I contextualize PNMS in Puerto Rico during the childbearing year and employ the concept of *local biologies* to identify how Puerto Rican experiences of stress and health outcomes are unique to a neo-colonial context – with economic precarity being identified as the

primary source of PNMS. Collectively, Chapter Two and Chapter Three set the stage for understanding how public health crises, such as the Zika virus epidemic and Hurricane Maria exposed the infrastructural vulnerability of the island and how this vulnerability is situated between feelings of powerlessness and strength for Puerto Rican women.

The final two chapters of this dissertation demonstrate the multiscale effect of unanticipated stressors. Chapter Four centers on the examination of the impact of the 2016 Zika virus (ZIKV) crisis on Puerto Rican women's experiences of PNMS – focusing on the disconnect between maternal beliefs and health behaviors in response to the ZIKV threat as they wrestled with the island's reproductive colonial past. This data was collected from the narratives in phase I of this research project which occurred during the height of the ZIKV crisis in Puerto Rico. Chapter Five is the conclusion of this dissertation which includes a post-script on my experience of Hurricane Maria, a natural disaster that devastated the island and interrupted my fieldwork three months shy of its end date. This conclusion outlines each chapter, connecting the multiple ways in which colonization serves as the most pervasive etiology of PNMS in Puerto Rico and identifies how this oppressive dynamic is exacerbated in the event of a public health crisis and a natural disaster.

Beyond the dissertation: forthcoming manuscripts

In total, 10 manuscripts associated with this research will be completed and submitted for publication (see Table 1.1). Four of these manuscripts (listed in Table 1.1 as one through three and number eight) are included in this dissertation (chapters two through five) with plans for the additional six to be completed and submitted for publication by 2021. Three of the additional six forthcoming manuscripts (listed in Table 1.1 as four, nine and ten) from this research project will focus on the quantitative measures that were collected during phase II of this research to

determine the predictive capacity of PNMS compared to biological measures of maternal stress. The other three of the six forthcoming manuscripts (listed in Table 1.1 as five through seven) from this research will contribute significant, methodological insight for CBC research, as human cortisol studies within anthropology have been plagued with multiple methodological limitations (Ice and James 2007).

Table 1.1 List of publications: Current and forthcoming

Article #	Topic	Author(s)	Intended Journal
1 ^a	Greatest MIH concerns – provider’s perspectives	Horan, H. & Cheyney, M.	Qualitative Health Research
2 ^a	Narratives of stress and pregnancy	Horan, H.	Medical Anthropology Quarterly
3 ^a	ZIKV as a stressor of pregnancy	Horan, H., Cheyney, M., & Nako, E.	American Journal of Public Health
4	Structured stress-survey data across pregnancy	Horan, H.	Journal of Pregnancy and Child Health
5	Hair cortisol concentration (HCC) data across pregnancy	Horan, H., Cheyney, M., Geeta, E., & Snodgrass, J.	Journal of Human Biology
6	Comparative analysis of survey and HCC data	Horan, H., Cheyney, M., Bovbjerg, M., Geeta, E., & Snodgrass, J.	American Journal of Physical Anthropology
7	HCC data and maternal and infant health outcomes	Horan, H., Cheyney, M., Bovbjerg, M., Geeta, E., & Snodgrass, J.	Psychoneuroendocrinology
8	Postpartum exit interviews – experiences of pregnancy and birth before, during, and after Hurricane Maria	Horan, H., Feliciano, Y., & Ortiz, F.	Social Science and Medicine

9 ^b	Laboratory methods of cortisol analysis	Geeta, E., Snodgrass, J., Horan, H., & Cheyney, M.	Journal of Biological Methods
10 ^b	Statistical analysis of structured survey data	Bovbjerg, M., Horan, H., & Cheyney, M.	American Journal of Epidemiology

^a Manuscripts included in this dissertation.

^b Co-authored manuscripts where I am not first author and that could be published out of order from this table.

Positionality Statement

Throughout the research process, I was acutely aware of the relationship between this ethnographic research and my positionality as a medical anthropologist, birth worker, daughter of a Puerto Rican woman, and a mother who is cis-gendered, heterosexual, able-bodied and neurotypical. Each aspect of my positionality contributed to my identity as a capable, reliable and trustworthy individual among my research partners, research assistants, pregnant women and families, birth workers, academics, community members, community organization affiliates, and clinicians both within and outside of the research locales. My positionality enabled me to foster close relationships with the mothers and families within and outside of my study, granting me the opportunity to build rapport and to observe the many of the inter-personal and institutional dynamics of PNMS I illustrate in these manuscripts. Another critical component of my positionality is that despite my Puerto Rican ancestry –I identify demographically as a White, *Latinx* woman in my early thirties. Puerto Rican’s describe themselves as not “having a look” and that people of all shades and styles can identify as Puerto Rican – and this proved true in the demographics of the study participants. Many of the participants and clients I worked with were relieved to know I was more than just a researcher – I was a mother of an infant/toddler and we bonded over “*el camino*” of life as busy mothers with small children. The same sentiment

resonated from the staff at the clinic and the community center where I worked and lived – almost all of whom were mothers or parents themselves. Collectively, this level of personal and cultural “insider” status granted me access and opportunities that may not have been available to me if participants identified me as an unrelatable, outsider (Bernard 2011; Naples 2004).

Part of my positionality-awareness includes acknowledging my markers of privilege and “outsider” status, primarily those of being highly educated and US born and raised. I was aware that these markers of privilege contributed to power dynamics between myself and those I encountered throughout the project, though I actively worked toward minimizing this differential by functioning under the assumption that Puerto Ricans are the experts on topics related to colonization, the health system and PNMS; by developing the larger dissertation research project in close collaboration with local Puerto Rican partners; by developing additional survey questions based on participant interviews; by informally checking in with participants about what they thought of this research; and with plans to return to the island and share/build upon preliminary findings with the community that represents this work (Hesse-Biber and Yaiser 2004). Collectively, these research efforts in addition to full transparency and humility are essential to managing the privilege that I represented and the impact that this had and will continue to have on my current and future research with and for the Puerto Rican people.

Notes

ⁱ Pilot study data indicates that adopting policies to reduce/eliminate elective cesareans before 39 weeks is optional and is likely a contributing factor to the persistently cesarean section and preterm birth rate (Horan and Cheyney forthcoming).

ⁱⁱ Originally it was planned that recruitment would occur only in *Cayey*. However, the partnering practice in *Cayey* has satellite clinics in *Cidra* and *Guayama* where clients can receive prenatal care. All clients deliver at the clinical facility in *Cayey*. We had 43 participants who received prenatal services in *Cidra*, and one who began receiving services in *Cayey* but transitioned to the office in *Guayama*, the remaining 45 participants received their prenatal care in *Cayey*.

ⁱⁱⁱ Revisions to our protocol, to include the collection of infant hair samples during the postpartum visit in phase II, was approved by the Oregon State University IRB on April 4th, 2017.

^{iv} After the initial hair sample was cut close to the scalp, a research assistant or I placed the hair sample on a piece of tin foil that was marked with an “X” at one end to indicate the scalp-end of the sample. With a ruler we measured 4 cm from the scalp end and cut the sample, removed the rubber band, and wrapped the sample in tin foil. The sample was placed in a small plastic ziplocked bag, labeled, and stored. The length of hair for subsequent visits is reflective of the unique growth rate of each participants hair between each of the visits in phase II.

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Chapter Two: Uprooting Etiologies: Experts Perspectives on the Syndemic of Poor Maternal and Infant Health Outcomes in Puerto Rico

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Abstract

Several studies have examined issues and posed hypotheses to explain elevated rates of poorer than expected birth outcomes among Puerto Rican women in comparison to other *Latinx/Hispanix* populations in the United States (US). However, the perspectives of Puerto Rican maternal and infant health (MIH) experts who live and work on the island is absent from the literature. Based on semi-structured interviews with MIH experts' in Puerto Rico, this article aims to elicit experts' perceptions of poor birth outcome causation within the populations they serve, as well as their insights on culturally congruent strategies to eliminate these health inequities. Maternal and infant health (MIH) experts (n=20) identified the preterm birth (PTB) and cesarean sections rates as two of the most significant contributors to Puerto Rico's elevated perinatal mortality rate. Expert perspectives provided critical insights on the cultural and sociopolitical contexts of MIH outcomes in Puerto Rico, helping to raise (and sometimes to answer) questions that have yet to be sufficiently addressed in the literature. We argue that MIH expert perspectives illustrate a syndemic framework of poor MIH outcomes in Puerto Rico, explaining how poor birth outcomes emerge at the intersections of the unique biological, cultural, environmental and political-economic contexts of US colony.

Introduction

Maternal and infant health (MIH) outcomes in Puerto Rico are persistently worse compared to the state-side United States (US) despite functioning, at least nominally, within the same maternity care system. Inequities are evident in multiple MIH outcomes, including perinatal mortality rates (PMR). The PMR captures all demises from 28 weeks gestation to 28 days postpartum (i.e. late neonatal death) and serves as a proxy indicator for the quality of prenatal, intrapartum and postpartum care (Centers for Disease Control and Prevention (CDC) 2018;

World Health Organization (WHO) 2006). Neonatal morbidities associated with preterm birth (PTB), infection, maternal hypertension and intrapartum asphyxia have been identified as the most common contributors to PMR, globally (Allanson, Muller and Pattinson 2015; Institute for Health Metrics and Evaluation 2013; Lozano *et al.* 2012). Puerto Rico's PMR is 7.9/1000—a rate that is significantly higher than the continental-US rate of 6/1000 (Association of Maternal and Child Health (AMCHP) 2018), lower than the estimated regional PMR for the Caribbean at 31/1000 (WHO 2006:18), and higher than the rate for state-side US *Latinx/Hispanic* populations (5.35/100; CDC 2018). Puerto Rico's status as an unincorporated territory of the US likely contributes to poorer than expected outcomes relative to demographically similar populations living and birthing within the state-side US (CDC 2003; Mulligan 2010).

Puerto Rico also struggles with high a preterm birth (PTB) rate relative to both the US states and other countries in the Caribbean. Preterm birth (PTB), a birth that occurs before 37 completed weeks of gestation, is the leading cause of neonatal death and the second leading cause of death for children under five globally (Goldenberg *et al.* 2008; Frey and Klebanoff 2016). Puerto Rico's PTB rate is currently 11.6 percent—more than two percentage points higher than the average for the US and in line with the US states with the highest rates of PTB rates; Louisiana, Mississippi, Alabama, West Virginia, and Puerto Rico all have premature birth rates of 11.5 per 1,000 live births or higher (March of Dimes (MOD) 2019). Preterm birth rates vary widely in the Caribbean, ranging from six percent in Cuba to 14 percent in Haiti (WHO 2012). Multiple clinical, social and environmental factors are associated with PTB, yet two-thirds of PTBs occur without any evident risk factor (Vogel *et al.* 2018).

The most significant disparity in MIH outcomes between Puerto Rico and the US states can be seen in nulliparous term singleton vertex (NTSV) cesarean delivery rates. Cesarean birth

is associated with an increased risk of maternal morbidities and mortality when compared to outcomes for vaginal deliveries, including an increased risk of hemorrhage, deep vein thrombosis, infection, complications from anesthesia, poor outcomes in future pregnancies, and neonatal respiratory problems, as well as higher medical costs associated with extended hospital stays (Vadnais *et al.* 2018). Factors associated with NTSV cesarean delivery include non-reassuring fetal heart tones, abnormal labor patterns and/or failure to progress, provider style and skill set for managing more complicated vaginal deliveries, and both medically indicated and elective induction (2018). Because of elevated risks to both mother and baby, there is a clinical imperative to reduce the rate of surgical birth within otherwise healthy populations (American College of Obstetrics and Gynecology (ACOG) 2014). The NTSV cesarean rate in Puerto Rico is 40.6% compared to 26% in the US states (CDC 2017a). This inequity contributes to a total cesarean section rate that, at 46.2%, is 14 percent higher in Puerto Rico and nearly one in two births (2017).

Several studies have examined these issues and posed hypotheses to explain elevated rates of poorer than expected birth outcomes among Puerto Rican women (Britton and Vélez 2015; CDC 2003; Landale *et al.* 1999; Landale and Oropesa 2001; 2005; Landale, Oropesa and Gorman 2000). However, the perspectives of Puerto Rican maternal and infant health experts who live and work in these communities has been missing from the literature. The purpose of this study was to elicit experts' perceptions of poor birth outcome causation within the populations they serve, as well as their insights on culturally congruent strategies to eliminate these health inequities. Using data collected from open-ended, semi-structured interviews (n=20), we aimed to understand why MIH experts believe PTB and NSTV cesarean sections

rates—two of the most significant contributors to Puerto Rico’s elevated perinatal mortality rate—remain persistently high relative to the continental-US.

Expert perspectives provided critical insights on the cultural and sociopolitical contexts of MIH outcomes in Puerto Rico, helping to raise (and sometimes to answer) questions that have yet to be sufficiently addressed in the literature. We elicited MIH expert perspectives and evaluated them using a syndemics framework (Singer 1994) with the aim of better understanding how poor birth outcomes emerge at the intersections of the unique biological, cultural, environmental and political-economic contexts of Puerto Rico (Singer and Clair 2003). We ask: Why has the overall cesarean section rate plateaued at 46.2 percent despite efforts to reduce it? Why is the PTB rate in Puerto Rico among the highest in the US, and what can be done to reduce it? What should be done in Puerto Rico to reduce elevated mortality rates driven by PTB and NSTV cesarean? Here, we present pilot research that was intended to be hypothesis generating, ultimately shaping the research design of a larger research project focused on the causes and consequences of PTB in Puerto Rico.

Background

Puerto Rico has a health insurance coverage rate of nearly 94 percent—a rate that is six percent higher than the US states (United States Office of the Assistant Secretary for Planning and Evaluation 2016). Compared to the US where 59 percent of the population receives employer-sponsored healthcare coverage, only 36 percent of Puerto Ricans have commercial health insurance with premiums paid by an employer or the consumer (Levis-Peralta *et al.* 2016). Commercial health policies in Puerto Rico have guaranteed issue, which means that they are offered without regard to health status (Perreira *et al.* 2017). However, according to Perreira *et al.* (2017:13) “...there is no individual mandate in Puerto Rico, no ability to risk-adjust

premiums, and no access to reinsurance programs to insure health plans against high-cost cases.” Mandates require health insurance plans to cover the costs of specific treatments, providers, and some categories of dependents, expanding insurance coverage while also increasing the cost of health insurance premiums (Buchmueller, DiNardo, and Valletta 2011). Without a mandate, commercial health insurance plans are less expensive, but there are no protections for the Puerto Rican health system in terms of covering costs for individuals with complex health needs (2011; Perreira *et al.* 2017).

In addition, Medicaid and Medicare reimbursement rates in Puerto Rico are 70 percent less than in the US states even though the island pays its equivalent in social security and Medicaid taxes – resulting in provider shortages and health service limitations (Roman 2015). Of the island’s 78 municipalities, the US Health Resources and Services Administration (HRSA) has deemed 72 of them medically underserved (Levis-Peralta *et al.* 2016). Within these underserved areas, 23 percent of the municipalities need pediatricians, and 68 percent have a shortage of obstetricians and gynecologists (Kaiser Family Foundation 2018; Levis-Peralta *et al.* 2016). Primary midwifery care is generally difficult to access for individuals who cannot afford to pay for services out of pocket. Puerto Rican’s who receive Medicaid have also struggle to afford pharmaceutical prescriptions, because island residents do not qualify for the low-income subsidy (LIS) part of the Medicare Part D coverage which facilitates access to low-cost medications (Centers for Medicare and Medicaid Services 2013). Numerous business closures have left Puerto Rico with only one pharmaceutical wholesale distributor, and with the absence of market competition, this distributor has little incentive to keep prices affordable (Perreira *et al.* 2017). This has resulted in Medicare enrollees splitting or sharing pills, spreading out dosages, and/or skipping prescribed medication altogether (2017). At a systems level, low fixed-

reimbursement rates for Medicare and Medicaid programs result in significant limitations in the provision of health care for enrollees who constitute more than 50 percent of the island's population (United States Department of Health and Human Services 2017).

Currently, Puerto Rico's top MIH healthcare improvement priorities include the reduction of PTB, low birthweight (LBW), and ZIKA virus (ZIKV) infections, as well as an increase in the infant survival rate (AMCHP 2018:1). Puerto Rico's MIH outcomes have shown notable improvements since the early 2000s, however, the majority of MIH measures on the island are still significantly worse than those in the larger US despite Puerto Rico having higher rates of early prenatal care initiation (2018). Puerto Rico's PTB and NSTV cesarean rates are likely associated with significant disparities in other MIH outcomes including early term delivery (37.1 versus 23 percent), early elective deliveries (11 versus two percent), preterm-related mortality (232.3/100,000 versus 211.4/100,000) and low birthweight (10.5 versus 8.1 percent) (2018).

Existing research on etiologies of PTB in Puerto Rico hypothesize that causal factors of PTB differ significantly from the US states (Cordero 2013; March of Dimes 2018a; 2018b). In the states with the highest rates of PTB, it has been argued that institutionalized racism, poverty, teenage pregnancy, and maternal stress, among other factors, contribute to elevated PTB rates (Gravlee 2009; Mask Jackson *et al.* 2001; Jasienzka 2009; Kuzawa 2005; 2008; Kuzawa and Sweet 2009; McDade 2009; Thayer and Kuzawa 2015). Yet, in Puerto Rico, these common predictors of PTB are not significantly associated with the island's PTB rate. Access to prenatal care in the first trimester, maternal education, health insurance, mode of delivery (vaginal vs. cesarean), maternal age, multiple gestations, and tobacco use also do not reliably predict PTB in Puerto Rico (Cordero 2013). Given this lack of clarity on PTB causation, we aimed to identify

the features of the Puerto Rican maternity care system (within the larger political-economic context of the island) that MIH experts believe are the most critical (and ideally potentially modifiable) contributors to poor outcomes.

Methods

Data Collection

Data were collected in July and August of 2014 in one large metropolitan area in Puerto Rico. Maternal and infant health (MIH) expert study participants were all employed as public health professionals and/or as clinicians, working in a variety of settings including community based MIH organizations, labor and delivery units, pediatric units, academic settings, and MIH grassroots not-for-profit organizations. The Institutional Review Board at Oregon State University approved this pilot study in the spring of 2014.

We used nonprobability quota sampling (Bernard 2011) to recruit Puerto Rican MIH experts wherein individuals from the sample population of interest were told about the study by email and/or phone calls and invited to participate in an interview. The first author also created business cards that included the timeframe for the study, a brief explanation of the research and contact information for prospective participants. MIH experts who engaged in interviews were encouraged to share these cards with interested colleagues, and potential participants who self-identified to the first author when interested in participating.

During interviews, we used semi-structured guides so that each expert was presented with the same, open-ended questions, permitting systematic comparisons across individuals and groups while also allowing for heterogeneity in participant responses, especially across provider types. The first set of interview questions inquired about the primary MIH concerns in Puerto Rico. The second set of questions covered topics related to existing programs, resources and

individual ideas about how to improve MIH outcomes. Participants provided voluntary, written informed consent; all interviews were audio-recorded and transcribed verbatim by the first author and two research assistants. Interviews were conducted in English and lasted 30 to 60 minutes depending on the amount of information the participant wished to share.

Data Analysis

Open, consensus coding was used to identify themes in expert interview transcripts. Inductive or “open” consensus coding is an approach where each researcher independently codes the transcripts and produces a preliminary list of topical and theoretical codes or concepts (Creswell & Poth 2013). Researchers then identify overlapping and non-overlapping themes, discussing any non-overlapping themes until consensus is reached. We engaged in consensus coding because it allowed for a diverse range of codes to emerge from participant narratives, as researcher positionality is known to influence which themes are identified and prioritized and which were overlooked (Maxwell 2013). In addition, the use of multiple coders has been shown to add rigor to qualitative data analysis making it more likely that findings will accurately and dependably reflect the range of experiences conveyed in interviews (Bernard 2006; Creswell 2006). A preliminary list of codes were also shared with a voluntary sample of participants and member checked (Birt *et al.* 2016). Theoretical analysis and consensus coding enabled us to co-construct findings with participating MIH experts and to identify themes that focused on aspects of the existing health system, provider practices, specific MIH outcomes and potential solutions.

Results

Twenty MIH clinicians and public health professionals participated in expert interviews, representing multiple areas of expertise (see Table 2.1). All participants identified as Puerto Rican and were over the age of 17. Participants identified several clinical MIH concerns,

including high rates of gestational diabetes, preeclampsia, gestational hypertension, and intrauterine growth restriction. However, PTB and the high cesarean section rate were consistently reported as the greatest MIH concerns on the island.

Table 2.1 Professional Occupation of Interviewees (n=20)

Maternity Care Profession	%(n)
Certified Professional Midwife ^a	20 (4)
Certified Nurse Midwife ^b	5 (1)
Doula ^c & Lactation Consultant	5 (1)
Labor and Delivery Nurse	5 (1)
Obstetrician	20 (4)
Pediatrician	25 (5)
Perinatal Psychologist	10 (2)
Public Health Professionals	10 (2)
<i>Academic</i>	<i>50 (1)</i>
<i>Non-Profit</i>	<i>50 (1)</i>

^a A trained and skilled independent practitioner who practices in the community setting (e.g. home or birth centers) in the US, Canada, and/or Mexico who has received certification set by the North American Registry of Midwives (NARM; NARM 2019).

^b Advanced nurse practitioners who have obtained an advanced degree, special certification, and training to provide reproductive health and maternity care services either in the hospital or community-setting (Nurse.org 2019).

^c A non-clinical, trained professional "...who provides continuous physical, emotional and informational support to a mother before, during and shortly after childbirth" (Doulas of North America International 2019).

Data from expert interviews revealed three themes. The first two themes: 1) *Everyday stressors: Poor nutrition, contaminated water and psychosocial stress* and 2) *Defensive Medicine: Induction, Reimbursement and Time in Maternity Care*, describe causal factors for Puerto Rico's high PTB and cesarean section rates that spanned the micro and macro level. The third theme: 3) *Medicina Integrada as a Potential Solution* elaborates on system-correcting solutions to the two MIH issues participants highlighted as most pressing—PTB and the NSTV cesarean birth rate. Collectively, these themes (for a summary of themes and subthemes, see

Table 2.2) describe how Puerto Rico’s political and economic relationship with the neocolonial powers of the US influences the quality, stability and accessibility of maternity care. Based on these findings, we argue that while high PTB and cesarean birth rates proximally contribute to high PMRs, that the ultimate contributors include neocolonialism and infrastructural oppression that flows from institutions to negatively affect individual pregnant women and their babies in Puerto Rico.

Table 2.2 Themes and Subthemes

Theme	Subtheme
1) Everyday stressors	1) Poor nutrition
	2) Water contamination
	3) Psychosocial stress
2) Defensive medicine: Induction, reimbursement and time in maternity care	1) Solo obstetrics
	2) Fear-based medicine
3) <i>Medicina Integrada</i> as a Potential Solution	1) Integrated care
	2) Education

Theme 1: Everyday stressors: Poor nutrition, contaminated water and psychosocial stress

Participants argued that three pervasive and unrelenting, everyday stressors put Puerto Rican women at elevated risk for PTB and cesarean delivery: 1) poor nutrition; 2) water contamination; and 3) psychosocial stress. Experts argued that these factors do not work in isolation. Instead, poor diet, high levels of pollution and social stress intersect and intensify the everyday experiences of stress among pregnant people in Puerto Rico.

Poor Nutrition

Every participant discussed the connections they see between “bad nutrition” and poor MIH outcomes on the island. Puerto Ricans were described as having what some called a “mono diet”

comprised of white rice, beans and meat, where “they don’t eat vegetables or drink enough water.” Participantsⁱ argued that poor dietary habits were “simply part of the Puerto Rican culture,” and that these factors contribute to a high prevalence of overweight and obesity in addition to associated health conditions such as hypertension and diabetes. Celeste, a community midwifeⁱⁱ who has been practicing for more than 20 years, summarized her perspective on the connection between poor diet, socioeconomic status, culture and poor MIH outcomes in Puerto Rico:

“There's a lot of junk food that people eat here, a lot of fast foods, a lot of government assistance and a lack of education around diet. It's like healthy food is considered, ‘Oh if you eat healthy, you eat rice and beans’ and its rice and no vegetables. There are people who just don't eat vegetables here. They don't drink water, and they just drink Coca-Cola all day. That's the culture here. So that—the lack of really good nutrients in Puerto Rico is probably one of the biggest causes of a lot of the maternal health issues which shouldn't be, such as premature labor, high blood pressure, preeclampsia, diabetes.... There's a lot of diabetes here.”

Stella, a doula and lactation consultant, argued that chronically poor diets lead to poor overall health, which puts pregnant women at risk for medical mismanagement, and ultimately, outcomes such as PTB. Stella explains that because of malnutrition, Puerto Ricans “don’t have any natural defenses,” especially in an immune-suppressed state like pregnancy (Mor and Cardenas 2010). She also connects malnutrition to poor microbiome health explaining that, “normal healthy bacteria is really messed up here.” She sees malnourished mothers as having an increased risk of infection during pregnancy, and physicians, she asserts, “just keep throwing antibiotics at them.” Stella worries that high rates of infection during pregnancy are leading to premature rupture of membranes and PTB.

Many participants also explicitly discussed the association between poor maternal dietary habits and high rates of obesity, arguing that fear of large babies and the diagnosis of gestational diabetes leads many doctors to induce early or to encourage women to “just schedule a

cesarean.” All participants described either providing counseling or referring patients for nutritional counseling as part of their prenatal care. While some participants saw poor maternal nutrition as the result of a lack of knowledge around healthy eating, others asserted that poverty and the higher costs of healthy food were to blame. Nonetheless, all agreed that when poor maternal nutrition intersects with a Puerto Rican maternity care system “stretched too thin,” PTB and cesarean section rates rise to higher than expected levels, and mothers and babies suffer the consequences of such structural inequalities.

Water Contamination

Alongside concerns over poor diet, experts also worried about water contamination due to environmental pollution. Puerto Rico has more than 200 Environmental Protection Agency (EPA)-identified contamination sites; many of which are unlined landfills near the karst aquifers on the north coast (Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) 2013; United States EPA 2017). Participants were well aware of these sites and argued that the abundance and location of them, combined with the likelihood that these pollutants have spread, means pollution cannot be ignored as a key contributor to poor birth outcomes such as PTB. Gabriel, a pediatrician and public health professional, narrated how the findings from the Cordero (2013) study found no significant relationship between common epidemiological factors associated with PTB in the US and the rate of PTB in Puerto Rico, prompting researchers, he asserted, to “look at other root factors.” Gabriel continued by describing how ongoing research in Puerto Rico by the PROTECT Center was beginning this work by investigating the relationship between PTB and the prevalence of environmental contaminants, such as endocrine disrupting chemicals like phthalates, on the island. Phthalates are toxic chemicals commonly found in personal and household products, and it is suspected that increased fetal exposure to these toxic

compounds during the prenatal period is associated with PTB and reproductive health abnormalities (Bedoux *et al.* 2012; Braun and Hauser 2011; Calafat *et al.* 2008; Colon *et al.* 2000; Dann and Hontela 2011; Krause *et al.* 2012; Meeker *et al.* 2013; Rubin 2011). Gabriel asserts: “What we know so far from the early data is that, overall, women in Puerto Rico have about three times the level of phthalates relative to women in the US [states].”

Participants also believed that water contamination was implicated in other maternal conditions associated with PTB such as HELLP syndrome—a variant of pre-eclampsia that includes the following indicators: hemolysis, elevated liver enzymes, and low platelet count. Left undetected, HELLP can result in seizures, stroke, liver rupture, and placental abruption (Haram, Svendsen and Abildgaard 2009). Mia, a midwife who works in an integrated midwifery and obstetric practice, describes how a personal friend’s experience shifted her mindset about the relationship between maternal health and water quality in Puerto Rico: “I had a very close friend who was very healthy that still ended up with HELLP syndrome, and I thought, ‘well maybe it’s the water’. At the very least, it’s the contamination on the island.”

Ivan, a pediatrician and breastfeeding support specialist, relies on water contamination as part of his explanatory model for poor birth outcomes in Puerto Rico, but is skeptical when a focus on pollution and contamination distracts from what he sees as larger, systemic issues characteristic of the island’s maternity care system. When asked about the relationship between water contamination and birth outcomes such as PTB, Ivan said: “I don’t know. They [researchers] talk about many things such as contamination...But they don’t talk about the doctors doing labor inductions before they are needed and how that leads to more preterm births because we don’t always know when people are due, as well as to too many cesarean sections

because mothers are not really ready to give birth.” Like Ivan, many participants argued that there were multiple, intersecting causal factors; contaminated water is only one of them.

Psychosocial Stress:

Several participants described various forms of “social stress” as a potential etiology for PTB and elevated cesarean section rates, as well as for other poor MIH outcomes in Puerto Rico.

Yarelis, a perinatal psychologist, academic, and birth rights activist connected persistent political and economic inequities with prenatal stress saying: “Women describe their prenatal experience as stressful. We [Puerto Ricans] are all living in stress right now...we are all low socioeconomic status.” She continued, associating poor MIH with financial struggles and interpersonal stressors such as domestic violence, saying: “A lot of women in their pregnancy are having difficulties with their relationships, so domestic violence or interpersonal, gendered violence. On the whole, Puerto Rico is a very stressful place to be a pregnant woman.” Other social conditions such as loud music and “hearing people screaming all the time” were also thought to contribute to poor MIH outcomes, creating hectic living environments and inevitable social stress. Claudia, a pediatrician and public health professional, connects these omnipresent, everyday stressors to the daily concerns of those who were expecting: “Poor prenatal care, poor nutrition, and water contamination” are continuously on the minds of pregnant women in Puerto Rico.

Theme 2: Defensive Medicine: Induction, Reimbursement and Time in Maternity Care

In Puerto Rico, the maternal health system struggles to function due to low government-funded health insurance reimbursement rates for both vaginal and cesarean births. According to expert interviews, government insurance reimbursement rates range from \$600 to \$1,200 for a vaginal birth, and from \$300 to \$900 dollars for a cesarean birth with rates varying based on the type of coverage (i.e. private versus public) and the location of care. One participant reported that

cesarean births are reimbursed at \$300 less with the intent to “incentivize” vaginal birth. Compared to the US states, these reimbursement rates are shockingly low, as the average Medicaid reimbursement rates are around \$9,000 for a vaginal birth and about \$13,000 for cesarean birth (Truven Health Analytics 2013:6). Participants explained that with government plans to eliminate regional private health insurance monopolies in favor of island-wide, privatized health insurance, the Puerto Rican health system and its care providers will likely remain buried under the financial debt of Medicaid costs for the foreseeable future. Institutional limitations have resulted in a low provider to patient ratio as experts estimated that despite having more than 500 trained obstetricians on the island, only a fifth of these providers practice obstetrics. Participants argued that two aspects of the maternity care system that contribute to the island’s elevated PTB and cesarean delivery rates are: 1) solo obstetrics and 2) fear-based medicine. Below participants describe how both factors were the result of the constricting economic structures of the Puerto Rican system.

Solo Obstetrics:

Unlike many obstetric and midwifery practices in the states, where labor and delivery units and birth centers rotate on-call shifts for providers, many providers in Puerto Rico work in high-volume, single-provider practices. Solo obstetrics was defined by one participant as: “One obstetrician per labor and delivery unit working 300 days a year at a rate of 30 to 50 births per month” in order to “cover costs and to make a reasonable wage while working within a system where insurance reimbursement is so low.” Participants explained that solo obstetric practice, and its associated financial burdens, have caused the “quality of maternity services to deteriorate in Puerto Rico over time.” Celeste, the community midwife, critiques the obstetric system

particularly for patients who are higher risk, describing it as a standardized practice of maternity care that lacks empathetic and evidence-based protocols:

“There’s lots of overweight women...obese women... They’re not focusing on their health so much because of the lack of care that they’re really getting when they get to an obstetrician, it’s like, ‘OK, how many weeks are you? Oh twenty-five, let’s do a sonogram. Oh, don’t eat so much! Your blood pressure is a little high, okay see you next time...”

Celeste connects the structure of obstetric medicine in Puerto Rico with maternal morbidities that result from unnecessary interventions, substandard care and mismanagement of medical complications of pregnancy. She sees these as ultimately driving the PTB and cesarean birth rates:

“And so, you see that [obstetric maternity care] and then the prematurity and the high blood pressure and the diabetes. I would say those are the babies that end up having C-sections.”

Other participants explained how, given the current structure of the health system, obstetricians see it as “necessary to regulate labor, so that it becomes easier to manage.” However, the “ease of management” does not necessarily equate to cost savings, and as a few of the midwives who participated noted, it begs the question: “easier for whom?” Scheduled inductions were described as the primary medical intervention used to regulate birth within the hospital, allowing nursing staff to manage most of the labor process without needing extensive oversight from the obstetrician. Some obstetric providers lamented that with the current limitations in obstetric practice, providers “don’t have the patience or the time to really follow a woman in labor.” This, they note, results in a higher rate of non-medically indicated inductions. Other participants argued that a “lack of patience” and the subsequent high rate of inductions contribute to high cesarean birth rates among healthy women and increased reports of birth trauma. Camila, a certified-nurse midwife, describes how induction helps to efficiently manage obstetric practice, yet is not practical when calculated as a per-hour expense:

“The average induction [in Puerto Rico] is two to four hours though guidelines say 16 to 18 hours of active labor before it is considered failure to progress. So, even a [short] two to four-hour induction is not going to make a difference economically [when comparing a vaginal versus a cesarean birth]. The incentive to do [non-medically indicated] inductions is nothing really other than time.”

Camila continued by arguing that non-medically indicated inductions and unnecessary cesarean sections were conveniently scheduled to accommodate the Monday through Friday work week, emphasizing that “the highest C-section rates are on Tuesday and Wednesday” and that “if the head is not crowing by the time the work day is done, then it’s a C-section.”

All participants understood that a higher rate of inductions, especially for first time mothers, led to a too-high rate of “unnecessary cesareans” and PTB due to the chance of inducing and/or surgically delivering women who were not sure of their due dates. Highlighting the island’s nearly 1:2 NSTV cesarean birth rate, some participants referenced local data, claiming that there were regions of the island where 70 to 98 percent of the births resulted in a cesarean—more than five times the 10 to 15 percent cesarean rate recommended by the World Health Organization (2015) and more than double the cesarean birth rate in the US states (CDC 2017a)! Several participants also expressly identified a connection between the high rate of early induction, often at 37 weeks gestational age, and the high rate of PTB. Camila describes this connection: “I learned about the high rate of induction supposedly [at] thirty-seven (37) weeks. And that was assuming it [the fetus] was thirty-seven (37) weeks, it could be thirty-five (35) weeker - that’s why we have a high prematurity rate.”

All participants highlighted the need to reduce the surgical birth rate and understood that “poor health” associated with maternal morbidities such as pre-eclampsia and the emotional trauma of unplanned (and often unwanted) cesarean births were critical issues needing to be addressed on the island. Celeste explained how despite being a homebirth provider, she

understands the utility of cesarean birth when necessary and in her practice, strives to normalize vaginal and surgical modes of delivery:

“There’s so many reasons why cesareans are necessary, that are not just because of true CPD [cephalopelvic disorder] or because the baby is under-stress...it goes way deeper than that...that’s why we work with the mother. You can still connect with your baby. You can still breastfeed. So, I am trying to learn how I can work with [families] on this so they don’t feel bad or traumatized about it, you know? So, they can see this as an option, because some, you know, cesareans actually can save a life.”

Despite universal discussion of the need to reduce unnecessary cesareans, while finding better ways to support those women who end up giving birthing surgically, all participants expressed frustration with how difficult this task is shaping up to be; the constraints of solo practice are thought to be a major contributor to the intractability of the island's cesarean rate.

Fear-based Medicine

In addition, participants characterized Puerto Rico’s medical system as functioning within a “fear-based” culture that encourages providers to practice “defensive medicine.” defined by participants as provider’s shaping their practice in response to the fear of litigation related to medical malpractice. In Puerto Rico, health insurance companies, their lawyers and existing legislation effectively force providers to practice medicine with an emphasis on minimizing liability. Luis, a perinatologist, describes why maternity care providers are “afraid of being sued” as a result of the high liability associated with obstetric practice in Puerto Rico:

“Here, you have the right to sue anyone, and the cost for the patient [to sue] is nothing...and they sue you for whatever they want \$2,000,000, \$4,000,000, \$5,000,000 and there is no control there because they [the patients] know you are going to settle and [they will] get some money. In the end. we settle because if not, I shut down my office for five days for a trial, and I still have to pay my secretary, my nurses, and my administrator...I can’t say to patients that are supposed to deliver this week ‘Hey hold on one week, I’m going to be in trials.’ Then I have to pay someone to cover all of my calls. So, the quantity of money I am going to lose, it’s humungous and the lawyers know that!”

Some participants also described the ways that the practice of defensive medicine can result in “provider-patient aggression,” particularly for patients who question the clinical need for a cesarean birth or when requesting information about vaginal birth after cesarean (VBAC). Others argued that providers used liability as an excuse to control birth “for [their] convenience”. Mia, a midwife from a combined midwife-physician integrated practice, described how VBAC clients in her practice had previous births with hospital-based providers who used intimidation to convince them to proceed with a cesarean birth by making threats such as, “you are too small, you are too big, you don’t have enough amniotic fluid, or your baby’s going to die!” Luis, the perinatologist, explained that from the physician’s perspective, the topic of VBACs can be triggering for obstetric providers who work in a health system premised primarily on reducing liability:

“Ninety-nine percent of OBGYNs do not want to do VBACs and its simply because of liability. Liability is very high and now you have patient attempting a vaginal delivery versus 45-minutes with a C-section so it’s [cesarean births rather than VBACs] are more cost effective. They’re [the patients] are not going to sue you for a C-section, they’re going to sue you for the vaginal delivery where you didn’t perform a C-section on time.”

The threat of liability in obstetric practice was also seen as contributing to increased interprofessional discordances. Experts described some obstetricians as being “afraid until that baby is out” so they can “give it to the pediatrician and be done;” they argued that providers were more inclined to do the “‘wrong thing’ [unnecessary interventions] to protect from liability.” Participants also described how lawyers and the legal system, rather than the physicians, were ultimately responsible for medical decision making, as, in the words of one participant, “health insurance companies’ rule the Puerto Rican healthcare system.” Celeste described how defensive medicine limits potential collaboration between obstetricians and midwives and ultimately, stifles the opportunity to provide options for maternity care on the island:

“People know that there's a lot of malpractice and a lot of doctors have told me what has ruined medicine in Puerto Rico have been the lawyers... You don't do a cesarean and you get sued... If something happens to the baby or the baby has a shoulder dystocia and it gets cerebral palsy and you get sued... So a lot of people practice defensive medicine here so there's that fear-based of "Oh I'm going to get sued!" and then the doctors are like " Oh, I'm not going to be a back-up for a midwives because then if something happens in the home birth and you come here, I'm going to get sued!"

In these ways, from the perspective of participants, defensive medicine, a culture of fear and solo practice combine to produce suboptimal conditions for maternity care, a tendency to over intervene even in healthy births, and, as a result, more inductions and scheduled cesareans drive preterm and surgical birth rates to dangerous levels.

Theme 3: Medicina Integrada as a Potential Solution

Participants provided two solutions to the structural issues plaguing the Puerto Rican MIH system: 1) legal recognition of additional maternity care options such as midwifery care; and 2) increasing patient and provider educational initiatives. Maternal and infant healthcare (MIH) experts acknowledged that “personal, individualized treatment” was optimal for maternity care, but that this would require “a team like mindset between providers;” obstetricians cannot be “pinpointed” as the sole, liable provider.

Integrated Care

Participants argued that to improve MIH outcomes there needed to be stronger collaborations between midwives (hospital-based and community-based) and obstetricians—an argument that has also been made for the mainland US (Caughey and Cheyney 2019). Providers recognized the logistical challenges of providing integrated maternity care because of the unregulated status of midwifery in Puerto Rico. Currently, in Puerto Rico, midwifery practitioners have no legal protections or hospital privileges despite research showing similar, and for some variables, improved outcomes for healthy women without medically complicated pregnancies (Cheyney *et*

al. 2014). Though many obstetricians in Puerto Rico do not support midwifery or community birth, some MIH professionals believe increasing access to skilled midwives across birth settings is the primary way to improve outcomes in Puerto Rico, as midwifery and particularly midwifery in the community setting, have been shown to decrease both NSTV and PTB rates (Homer *et al.* 2014; Renfrew *et al.* 2014). Participants recommended the training and regulation of midwives as a viable solution that could be used to relieve the pressures on the current system. Understanding the potential for collaborative partnership, Hector, an obstetrician known for his support of community birth, described the dangers of a maternity care system that does not prioritize the integration of community-based midwives and obstetric providers:

“We, the doctors, cannot destroy the midwives and the midwives shouldn’t destroy the doctors. Because in reality, in the long run, we all integrate and truthfully need each other. If we are polarized who will suffer? It’s the family, we are supposed to serve...not serve ourselves. The safest thing for society is that everything is integrated, not polarized...In reality, what puts the family in danger is the lack of communication and the discoordination of the health system.”

Other providers suggested the incorporation of non-clinical providers, such as birth doulas and community health workers into the healthcare team as existing research shows that women who have access to doula care are more likely to have unmedicated, spontaneous vaginal births, to initiate and sustain exclusive breastfeeding, and to report being satisfied with their birth and early parenting experiences (Bohren *et al.* 2017).

Education

Participants also indicated that more education initiatives for providers and pregnant individuals and their families could improve MIH outcomes. Many participants suggested that provider education be offered in the form of courses with an emphasis on maternal mental health screening, the benefits maternal-infant contact in the neonatal intensive care unit (NICU), maternal and childhood nutrition, and breastfeeding. For pregnant individuals and their families,

several education initiatives were suggested with “the goal of empowering families.” Luna, a pediatrician, asserted that if you are “an educated woman...nobody will mess with you.” Providers overwhelmingly agreed that more and higher quality education related to pre-conception health, prenatal care, pregnancy health, inter-conception care, mental health, diet, medical literacy, breastfeeding and parenting classes, particularly for low-income and young families, would be transformative.

Educational outreach to low-income and young families was emphasized in expert narratives, with many arguing that doctors do “whatever they want with them, giving them less of an opportunity” to have access to quality maternity care. Providers described how the lack of information regarding VBAC and PTB was especially problematic for these populations who often had limited access to information and informed consent around these topics. Mia, the midwife from the integrated midwifery and obstetric practice, described her encounters with young, low income families having their first babies, desperate for information to make sense of their experiences and to better plan for their next pregnancy:

“I receive calls from moms...telling [me] stories of having their first baby at 13. How the doctors said ‘ah, your baby is too big’ and go to C-section and then the baby weighs six pounds. They probably want to try a VBAC but they have no information from their provider.”

Luna, a pediatrician, and one of the biggest advocates for education as a tool of empowerment for women, families and communities, discussed how the issue of PTB in Puerto Rico has contributed to the misperception of a what a “healthy baby” looks like:

“...I think we should empower people to understand...the look of a 40-week-old...it’s not a smooth-skin baby you know...that is a 36 weeker. So, we are losing that already, our women they don’t know what a newborn should look like and that is very scary.”

While no one argued that education alone was enough to improve MIH outcomes Puerto Rico, all participants recognized a critical need for better access to information around a wide range of birth and parenting related topics.

Discussion

Experts' narratives revealed a *syndemic* of poor MIH outcomes that are associated with Puerto Rico's status as a US colony. Participants identified how institutional inequities create an environment in which everyday stressors related to socio-economic challenges cause pregnant individuals in Puerto Rico to be less healthy at the start of their pregnancy. Experts also described how the Puerto Rican health system bears the brunt of political-economic inequities, resulting in maternity care practices that contribute to elevated rates of preterm and cesarean birth, while simultaneously limiting opportunities to improve these outcomes. To best elicit these relationships, we employ critical medical anthropologist Merrill Singer's (1994) syndemic framework to examine the population-level clustering of social and health problems. A syndemic is predicated on three core factors: (1) two (or more) diseases or health conditions cluster within a specific population; (2) contextual and social factors create conditions conducive to this clustering; and (3) the clustering of diseases or health outcomes results in adverse interactions—biological, social and/or behavioral – increasing the prevalence of health issues in affected populations (Singer *et al.* 2017). We argue that within the neo-colonial context of Puerto Rico, maternal morbidities that result from, or are exacerbated by, everyday stressors, in combination with the practice of defensive medicine, results in higher rates of PTB and cesarean delivery, elevated rates of perinatal mortality, as well as other poor MIH outcomes.

For nearly a decade, Puerto Rico has been experiencing an economic recession with significant cuts to economic and health care policies (Perreira *et al.* 2017). Puerto Rico's private

sector and gross national product have decreased partially due to the elimination of the Section 936 Internal Revenue Code, which incentivized US corporations to locate their subsidiaries on the island (2017). Throughout the recession, Puerto Rico has borrowed money in the form of municipal bonds to pay for public services, including healthcare services such as Medicaid, to support its shrinking economic base. After defaulting on payments toward the island's 70 billion-dollar debt, Puerto Rico's access to such capital markets was eliminated. In response, the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA) was enacted by the US Congress to assist with restructuring the island's debt. PROMESA's inability to develop an economic plan has resulted in reduced employment opportunities and reductions to the provision of healthcare, stunting the island's ability to pay Medicaid providers. This has resulted in public concern over the availability of these benefits and a subsequent steep increase in medical care utilization by beneficiaries who fear that their healthcare access will be significantly reduced if not eliminated in the future.

Participants indicated that ongoing political-economic struggles contributed to maternal morbidities such as gestational hypertension and gestational diabetes as a result of poor nutrition and elevated pre-pregnancy body mass index (BMI). Experts further emphasize these connections by explaining how pre-existing clinical conditions and maternal morbidities are associated with the island's elevated rates of preterm and cesarean birth. In Puerto Rico, 30 to 35 percent of the adult population has been identified as obese, meaning they have a BMI of 30 or higher (CDC 2017b; 2017c), with a recent study suggesting that more than 44 percent of pregnant individuals on the island have as pre-pregnancy BMI of overweight or obese (Guilloty *et al.* 2015). Overweight and obese women have been shown to have higher rates of maternal morbidities resulting in iatrogenic PTB and cesarean delivery (Sinha and Jastreboff 2013).

Puerto Rico's contemporary diet, rich in mostly imported starches, meat, some fruits, and sugar-laden drinks – is the result of dietary delocalization or, “the incorporation of non-locally produced food items in the diet, and the transition to a more ‘Western’ diet” (Cantor, Peña, and Himmelgreen 2013:480). Dietary delocalization in Puerto Rico is the result of several political-economic processes, including the 1920 Jones Act, which requires that commercial trade from one US port to another be conducted by a US owned and operated ship (Rodríguez-Díaz 2018). Due to such regulations, Puerto Rico's cost of living is extremely high for the Caribbean, and with 45 percent of the population living below the poverty line, eating a healthy diet is nearly impossible for a majority of the island's residents (United States Office of the Assistant Secretary for Planning and Evaluation 2016).

Experts also stressed the possibility that poor health outcomes could be associated with the island's high level of environmental pollution that results from lenient waste policies and the rapid industrial growth that occurred during the 20th century (Hunter and Arbona 1995). As many noted, endocrine disrupting chemicals (EDCs), such as plasticizers, are present at a higher level in Puerto Rican women of reproductive age than their state-side counterparts. A growing body of literature supports this hypothesis. Puerto Rican women have higher rates of a variety of endocrine-related diseases and disorders (PROTECT 2013). Industrial and consumer EDCs such as triclosan, benzophenone-3, dichlorophenols, and parabens commonly found in consumer goods have been detected in surface drinking water and have been shown to have an adverse effect on aquatic life and infant and childhood morbidities such as obesity, low birthweight, and premature female reproductive development (Bedoux *et al.* 2012; Braun and Hauser 2011; Calafat *et al.* 2008; Dann and Hontela 2011; Krause *et al.* 2012; Meeker *et al.* 2013; Rubin 2011). Developmental Origins of Health and Disease (DoHAD) research suggests that EDCs are

obesogens - environmental chemicals that stimulate fat accumulation during critical stages of fetal development – with the potential to disrupt lipid metabolism and to promote obesity across the life course (Newbold 2011).

Prenatal maternal stress (PNMS) due to financial inequities and gender-based violence were identified as additional etiologies of preterm and cesarean birth—a factor that likely intersects with other inequities such as a poor diet and an elevated BMI. Existing research suggests there be an association between PNMS and perinatal outcomes including PTB, though the physiological mechanisms between PNMS and parturition remain unclear. Contending theories of PNMS and PTB focus on chronic maternal hypothalamic-pituitary-adrenal axis activation, hypothesized to contribute to poor perinatal outcomes through biochemical mechanisms that cause dysfunctional, flattened cortisol responses (Duffy *et al.* 2018) and inflammation of the myometrium in the uterus (Gomez-Lopez *et al.* 2014). Stress has also been shown to increase the consumption of calorie-dense, low-nutrient food, with stress-driven eating more frequently identified in populations of women with an elevated BMI. Elevated levels of glucocorticoids, human hormones involved in anti-inflammatory and immunosuppression functions of the human stress response (Oakley and Cidlowski 2011), have been associated with higher levels of central adiposity and obesity, due to their release of several other hormones during stress responses that influence food intake and insulin sensitivity (Peckett, Wright, and Riddell 2011). The connections between PNMS due to economic inequities, poor nutrition and environmental teratogens and elevated rates of PTB and cesarean delivery combine to illustrate the ways neo-colonization affects individual biologies and MIH outcomes in Puerto Rico.

Participants associated elevated rates of PTB and cesarean delivery with everyday stressors but also with the structure of the Puerto Rican maternity care system. This lack of

obstetric services was tied by participants to low-health insurance reimbursement due to the island's political-economic status as an unincorporated territory. If Puerto Rico were a state, the government would cover more than 80 percent of its Medicaid costs. However, because of legislation passed in the late 1960s, the federal government reimburses the island for only 19 percent of its Medicaid costs in the form of block grants (Mulligan 2014). This deficit of providers and reimbursement contributes to high levels of burn out and "brain drain" of island-trained physicians who are lured to work elsewhere for higher pay. For those who stay, these financial limitations result in solo-provider practice, where physicians are working on-call, around the clock, and overburdened with births. Despite institutional incentives to reduce the cesarean birth rate, over-worked providers have resorted to the hyper-management of labor and delivery with the intent to make their workload manageable and to reduce liability.

Health insurance companies in Puerto Rico have a strong-hold on medical practice, further pressuring providers who are working within a woefully inadequate maternity care system. The high liability associated with maternity care causes many physicians to operate under the fear-based assumption that they could be sued for not intervening in the event of a bad outcome. This form of defensive medicine has led to skepticism from other maternity care providers, who claim that obstetricians' use of liability is a scape goat for wanting a more tightly managed practice, and that the desire to control birth contributes to higher rates of PTB and cesarean delivery. This tension between providers is also a result of the health care system itself, as obstetricians are the only legally recognized maternity care providers on the island. This reduces the likelihood that obstetricians and midwives or other allied maternity care providers like doulas can work collaboratively to care for women in hospital and community setting.

Deficits of the Puerto Rican health system can be easily witnessed from the patient's perspective. Scheduling appointments can take weeks, if not months for those with Medicaid as their primary insurer. Once the appointment date arrives, provider's offices often have long wait times because providers prioritize maximizing their fee-for service payments. Physicians often structure two blocks per day for visits, in the morning and afternoon, and patients arrive at the beginning of the block and can wait up to hours to have their appointment (Perreira *et al.* 2017). As a result of low reimbursement, providers will often limit their referrals to specialized care causing a delay in services. In addition, it is not unusual to have a long wait for laboratory testing appointments. Due to these structural deficits, patients may decide to use emergency room services, which also have extensive wait times of 90 minutes or more, but ultimately allows patients to access all the services they need in one visit (Mulligan 2014). These issues highlight the stress of accessing healthcare in Puerto Rico and how it is related to greater political-economic issues as a result of colonization.

As argued by participants, Puerto Rico would likely benefit from the expansion of maternity care options, as well as an increase in patient and provider educational initiatives related to physiologic birth; however, there are additional factors that need to be considered. Currently, community-based providers, because of their focus on holistic maternity care, serve a very small fraction of pregnant people compared to obstetric practitioner, providing services that cost, on average, between \$2,500 to \$3,000 per client. Obstetricians, many of whom serve clients across the socio-economic spectrum, are reimbursed at a fraction of this cost. If alternative models of maternity care were regulated and encouraged, there would need to be adjustments in the healthcare system that would adequately reimburse for services. Comprehensive reform of health care payment models is urgently needed as are increased intraprofessional and patient-

centered educational initiatives that would allow doctors and midwives to learn together and patients and providers to speak across differences and power dynamics to help improve maternity care in Puerto Rico.

Conclusion

Using a syndemics framework, we conducted interviews with Puerto Rican MIH experts with the intent to better understand why the PTB and NSTV cesarean sections rates—two of the most significant contributors to Puerto Rico’s elevated PMR—remain persistently high in comparison to the US states. Experts identified what we have described as a syndemic of etiologies associated with the island’s status as a US colony. The Puerto Rican health system bears the brunt of political-economic inequities, resulting in maternity care practices that contribute to elevated rates of PTB and cesarean birth, while simultaneously limiting opportunities to improve these outcomes. Institutional stressors also make the process of receiving maternity care increasingly challenging, creating an environment in which everyday stressors related to socio-economic inequities cause individuals in Puerto Rico to be less healthy at the start of their pregnancy. This study has identified multiple pathways for understanding poor MIH in Puerto Rico. Future research is needed to explore the depth of these connections and to identify how to assess the connections between social inequities and poor MIH outcomes in this context.

Notes

ⁱ In this dissertation, all the names for participants in this dissertation have been replaced with pseudonyms to protect confidentiality.

ⁱⁱ “Community midwives” are midwives who attend births at home and in birth centers or clinics in Puerto Rico and often do not have hospital privileges. There are sometimes referred to as out-of-hospital midwives (Cheyney *et al.* 2019).

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**Chapter Three: “*No te ahoges en un vaso de agua*”: Neocolonialism, Economic Precarity
and Maternal Stress in Puerto Rico**

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Abstract

Nuancing and advancing the literature on perceived prenatal maternal stress as part of the etiological pathway of preterm birth, I demonstrate how economic precarity in Puerto Rico, as a result of neo-colonization by the United States of America and recent political-economic tensions between these two entities, serves as the foundation for eliciting perceptions of maternal stress in a US colony. Based on 16 months of ethnographic research in community-based and private-maternity care settings, 25 interviews were conducted with pregnant and recently postpartum Puerto Rican women. Maternal narratives illustrated the embodied, interwoven nature of individual versus structural stressors of pregnancy in Puerto Rico, as well as the social expectations that are shaped by colonial, neoliberal perceptions of motherhood. My contextualization of the relationship between stress and birth outcomes is shaped by the framework of *local biologies*, where I argue that existing models for understanding health disparities unique to Puerto Ricans is not the result of biological or genetic determinism but, lies at the intersection of political-economic and health systems inequities. My analysis of prenatal maternal stress in Puerto Rico contributes to the critical medical anthropology of preterm birth and the anthropology of stress as I employ a multilevel approach to identifying associative and causal factors linked to perceived maternal stress and timing of delivery.

Introduction

Prenatal maternal stress (PNMS) is associated with more than 40 percent of preterm births (PTB) and is one of several factors involved in the complex etiological pathway of early delivery (Frey and Klebanoff 2016; Vogel *et al.* 2018). Preterm birth (PTB), one of the most important health indicators of a nation, is generally defined as a birth that occurs before 37 completed weeks of gestation and is the most frequent cause of death for children under the age of five (World Health

Organization (WHO) 2018). In addition, individuals who survive early delivery have higher rates of long-term morbidity, including neurologic and developmental disabilities, compared to infants born full term (Goldenberg *et al.* 2008; Frey and Klebanoff 2016). It is estimated that costs of PTB are approximately 26.2 billion dollars per year – a suspected undercalculation that excludes the impact of early delivery on parents, in addition to other long-term morbidities and societal costs (Aarnoudse-Moens *et al.* 2009; Frey and Klebanoff 2016; Hovi *et al.* 2007; Institutes of Medicine 2007; Petrou and Kahn 2012; Trønnes *et al.* 2013).

The National Institute of Child Health and Human Development’s Genomic and Proteomic Network for Preterm Birth Research’s spontaneous preterm birth phenotyping tool¹ has identified PNMS as the most prevalent phenotype associated with early delivery, particularly for mothers of color (Manuck *et al.* 2015). However, the mechanisms connecting early delivery, maternal stress and other social factors such as race and socioeconomic status remain poorly understood. Furthermore, numerous researchers have argued that conventional measures of disparities provide a limited framework for understanding the relationship between PNMS and poor birth outcomes (Braveman *et al.* 2015; Kramer and Hogue 2009; Landale and Oropesa 2005).

Puerto Rico, an unincorporated territory of the United States (US) in the Caribbean, has a persistently high PTB rate of 11.4 percent—more than two percent higher than the national average of 9.9 percent (March of Dimes 2019). Despite improvements following efforts to reduce Puerto Rico’s 37 percent elective labor induction rate (Moreno *et al.* 2014), the PTB rate remains approximately two percent higher than the aggregated *Latinx/Hispanic* population and two percent lower than the rate for non-*Hispanic* black mothers (currently 13.9 percent; Centers for Disease Control and Prevention (CDC) 2017a). Limited epidemiological research

suggests that the etiological factors associated with PTB are not statistically significantly associated with early delivery in Puerto Rico. However, the island's neo-colonial status, in combination with its unique geographic, socio-cultural and linguistic contexts, may contribute to unique experiences of PNMS relative to the continental US. Recent national epidemiological data masks health outcomes by using the catchall *Latinx/Hispanix* subgroup in maternal and infant (MIH) data and by employing US state-residing Puerto Ricans as proxies for understanding the outcomes of women living on the island. Such approaches risk homogenizing how researchers and clinicians perceive the relationship between PNMS and early delivery in the Puerto Rican context (Eick *et al.* 2018; Szegda *et al.* 2018).

Puerto Rico has been subject to centuries of colonial rule, with the current US regime resulting in a number of political and economic inequities and stressors. on the island that at the time of this study were referred to as *La Junta de Control Fiscal*. The analysis presented here is based on 25 ethnographic interviews with pregnant and recently postpartum women who live in Puerto Rico and who were pregnant during Puerto Rico's default on their more than 70-billion-dollar debt to the US. The purpose of this study was to contextualize PNMS in Puerto Rico during the childbearing year and to use the concept of local biologies (Lindenbaum and Lock 1993) to identify how Puerto Rican experiences of stress and health outcomes are unique to ongoing economic precarity in a neo-colonial context. Data collected for this study comes from a larger, mixed methods research project designed to examine the biocultural relationships between PNMS and gestational age at delivery. Maternal narratives provide a foundation for understanding PNMS in Puerto Rico, evoking the complex, interwoven embodiment of neo-colonization as it flows from institutions to individual mothers.

Background

Investigations of maternal stress in Puerto Rican populations are limited, yet arguably still provide a baseline for understanding PNMS in this population. In 2011, Bermúdez-Millán and colleagues conducted focus groups with 29 Puerto Rican women living outside of Puerto Rico in the continental-US, asking about community experiences and perspectives regarding general perceptions of stress and stress caused by racism, the impact of stress on women, their families and their communities, and stressors specific to maternal health. Analyses of participants' responses indicated that maternal stress was associated with work, providing for one's family, income, pervasive poverty, a lack of social support, a poor educational system, food insecurity, unsafe neighborhood environments and to a lesser-degree, experiences of discrimination.

Proyecto Buena Salud, a prospective cohort study that included predominately Puerto Rican women living in the US states from 2006 to 2011 utilized the Cohen Perceived Stress Scale to measure general stress during each trimester of pregnancy for 1,267 individuals. These researchers found that elevated levels of mid-pregnancy stress increased one's risk of PTB and low birthweight (Szegda *et al.* 2016). In 2018, Eick *et al.* measured the association between gestational age at delivery in Puerto Rico and maternal psychosocial stress with 922 mother-infant pairs by administering multiple structured surveys in the third trimester. Lower maternal education, unemployment and public insurance status were common among women who delivered preterm, though Eick and colleagues found no statistically significant associations between psychosocial stress and PTB.

Anthropologists have theorized about the relationship between PNMS and infant outcomes primarily from evolutionary, genetic and biological perspectives, arguing that experiences such as maternal famine, poverty, slavery, and discrimination have implications for inter-generational health disparities (Gravlee 2009; Jasienska 2009; Kuzawa 2005; 2008;

Kuzawa and Sweet 2009; Lende 2012). Studies with *Latinx* populations have used maternal narratives to contextualize the meaning of stress and its impact on MIH outcomes. Jackson's (2009) research showed that when pregnant women in *Jalisco*, Mexico, had perceptions of health that aligned with the predominate cultural model of health, they were more likely to have lower levels of perceived stress and pregnancy-related anxiety. A study by Fleuriet and Sunil's (2016) among Mexican immigrant women living in the US found that the longer a mother lives in the US, the more likely she is to have a negatively impacted psychosocial profile during pregnancy, as well as an infant with a lower birthweight compared to more recent Mexican immigrants from the same population. David and Collins (2007) found similar relationships and birth outcomes among first generation African immigrants and African American mothers. Collectively, this body of work suggests a biocultural connection between PNMS and birth outcomes that is driven by cultural context. However, no study has elucidated the experience of Puerto Ricans who are simultaneously part of the US and "othered".

Arroyo (2013) has argued, based on research conducted in Caguas, Puerto Rico, that an unusual intersection of PNMS underlies MIH outcomes. In a cross-sectional study of 67 Puerto Rican mothers who delivered within the previous 60 days, participants completed a one-time questionnaire that measured general and pregnancy-specific stress. Relevant clinical information including the ponderal index were extracted from participant medical records. The ponderal index is a calculation that includes infant weight and height and is used to assess the pattern of fetal growth in small-for-gestational age infants (Armangil *et al.* 2011). Women experiencing elevated levels of stress in mid-pregnancy, as well as those with "relationship stress" were more likely to have infants with a higher ponderal index – a finding that complicates existing stress and birth outcomes literature. Significant differences in birth weight

and ponderal index were also associated with paternal self-identified ethnicity rather than maternal self-identified ethnicity. Arroyo (2013) argues that fathers who identified as Hispanic had the heaviest babies with the highest ponderal index, White fathers had the babies with the lowest birth weight, and mixed-race or black fathers had the babies with the lowest ponderal index. In addition to birthweight and ponderal index, neonates of White fathers were born the earliest when compared to mixed-race or black fathers – an inverse pattern from what has been identified in the US-states (Collins Jr, Rankin, and David, 2011; Dominguez *et al.* 2008; Frey and Klebanoff 2016; Vogel *et al.* 2018).

Theoretical Framework: Local Biologies

Here, I employ Lindenbaum and Lock's (1993) notion of *local biologies*, emphasizing the interactions between the social and the biological experiences of the pregnant Puerto Rican body with the intent to disrupt the naturalized divide between nature and culture when thinking about health outcomes. Local biologies “refers to the way in which the embodied experience of physical sensations, including those of well-being, health, and so on, are in part informed by the material body, itself contingent on evolutionary, environmental, and individual variables”; where the biological and the social being are “coproduced and dialectically reproduced” (Lock *et al.* 2000:484). Local biologies originates from the rich traditions in anthropology that examine how culture, an integral component of the human experience, influences the subjective experience and individual performance of illness (Good 1993; Kleinman 1982; Lindenbaum and Lock 1993; Masquelier 1997). Lock and Nyugen (2010) argue that the medicalization of the body, with the spread of biomedicine, has manifested in various forms specific to cultural and political-economic contexts. While pregnancy is arguably not an illness for most women, it has been heavily medicalized within modern US-style obstetrics (Cheyney 2011; Davis-Floyd 2004;

Neiterman 2012), and thus, through participants' narratives, I describe how discussions of stress during pregnancy often fit within pregnancy-as-disease models as well as within the historical and shifting cultural expectations of pregnancy, birth, and motherhood in to Puerto Rico.

Anthropologists have an extensive history of investigating the effects of biocultural factors on the process of embodiment and health (Arroyo 2013; Gravlee 2009; Jackson 2009; Jasienska 2009; Kuzawa and Sweet 2009). I extend this work to argue that simple models for understanding health disparities in Puerto Ricans, such as the Puerto Rican Health Disadvantage (PRHD) (Barcelona de Mendoza *et al.*, 2016; Britton and Velez 2015; Roy, Hughes and Yoshikawa 2013; Rivera and Burgos 2010) risk further stigmatizing and normalizing the suffering of Puerto Rican people. The PRDH highlights the significant degree of heterogeneity in *Latinx/Hispanix* population-level health data in the US, prompting the question of why Puerto Rican have worse perceptions of self-reported health and health outcomes compared to demographically similar populations (Roy, Hughes and Yoshikawa 2013). Using the concept of local biologies, I argue that this PRHD model calls attention to disparities without sufficiently incorporating a systems level approach to MIH outcomes that focuses on inequities caused by the institutional, neo-colonial abuse of US citizens.

Methods

Twenty-five women, older than 17 years of age who were either currently pregnant or recently delivered (no greater than six weeks postpartum), were recruited from two sites: a local MIH community-based organization and a hospital-based non-profit breastfeeding support group in the neighboring *municipios* of *Carolina* and *San Juan*, Puerto Rico. These *municipios* are approximately seven kilometers apart on the island's northeast coast; both are part of the *San Juan-Caguas-Guaynabo Metropolitan Statistical Area*. Nonprobability quota sampling was

employed wherein I invited the sample population of interest to participate, and all participants engaged in the study voluntarily (Bernard 2011). This project was approved by the Institutional Review Board of Oregon State University in April of 2016.

In partnership with the two recruitment sites, fliers were distributed at each site inviting eligible individuals to contact researchers if they were interested in sharing their experiences and perceptions of stress during pregnancy. The recruitment flier indicated that each interview was voluntary, would take approximately 30 minutes to one hour to complete, be scheduled at the mothers' convenience, occur at a site of their choosing, and that they would receive an infant sling carrier as compensation for their time and participation. Interested mothers self-identified, indicating their interest by contacting researchers either in-person or by telephone. Prior to obtaining verbal consent, the research assistant and I briefly explained who we were, our motivation for the project and that the aim of the study was to better understand how stress impacts MIH in Puerto Rico. Informed consent documents, in addition to all approved study documents, were available in English and Spanish and reviewed by all potential participants prior to giving consent.

Consented individuals completed an eligibility questionnaire that was divided into three sections. The first section of the questionnaire, "Demographic Questions", included basic information such as the mother's sex, age, marital status, race, ethnicity, and *color*, how long and whether they were currently living in Puerto Rico, their citizenship status, education level, as well as income-level and occupation. Distinct from the North American concept of race, *color* is a cultural concept used in Puerto Rico to refer to one's social status based not only on the color of one's skin but also other intersecting components of their identity including hair type, social status, wealth, education, family background and residential area (Goodman 2016; Kuzawa and

Gravlee 2016; Gravlee, Dressler, and Bernard 2005 Leatherman, Hoke and Goodman 2016). The second section, “General Health Questions”, included questions about the participant’s health insurance type, smoking status, current perceived stress levels, as well as pre-pregnancy weight and height. The third section, “Pregnancy Questions”, were used to determine eligibility for the study and included questions such as “How many weeks pregnant are you?”, as well as specific information about their prenatal care services and reproductive health histories. Upon completion of this questionnaire, researchers were able to determine if the individual was eligible to participate in an interview.

Researchers conducted individual, semi-structured interviews with eligible participants face-to-face or by telephone. Interviews were conducted between August and September of 2016, in Spanish (n=18) and English (n=7) predominantly, with many individuals mixing in some Spanish or English words and phrases. The interview guide was translated and back translated in Spanish in order to promote consistency between the English and Spanish versions of the interview questions. Interviews were audio recorded with the individuals’ consent, de-identified, translated into English when needed and transcribed verbatim. Interviews ranged from 10 minutes to one hour in length, with an average interview duration of approximately 30 minutes. Interview transcripts and ethnographic fieldnotes were coded to identify representative themes related to mothers’ perceptions and experiences of stress during pregnancy.

Participant interviews were coded using QSR International® NVivo, a qualitative analysis software program. The author employed a modified grounded theory approach to data analysis (Charmaz 2006; 2011; 2014), identifying a list emic codes related to stress during pregnancy that emerged from participant narratives. This approach allowed theoretical categories to come from the data itself, rather than by reasoning from the researcher with the intent to

reduce the influence of investigator bias on the research findings. A modified grounded theoretical framework allowed for the construction of data analysis and findings as she approached this topic without knowing detailed information about PNMS in Puerto Rico. Interview data and ethnographic fieldnotes were coded to identify representative themes related to mothers' perceptions and experiences of PNMS.

Results

Twenty-five pregnant (n=14) and recently postpartum (n=11) Puerto Rican women completed the eligibility questionnaire (see Table 3.1). Twenty-four individuals identified as women with one participant not answering this question. All participating individuals were living in Puerto Rico at the time of the interview; 21 were Puerto Rico-born and four had lived on the island for five years or more. Ethnically, participants identified as *Latinx/Hispanix* and none were immigrants; the four individuals who did not identify as island-born were born elsewhere in the US. None of the participants reported smoking during their pregnancy, and all began receiving prenatal care in the first trimester. Women in all three trimesters of pregnancy participated in interviews.

Table 3.1 Select Demographic, General Health and Maternal Reproductive Health Characteristics (n=25)

Characteristic	%(n)
Pregnant	
No	44 (11)
Yes	66 (14)
Age	
18-24	12 (3)
25-30	20 (5)
31-35	52 (13)
35-40	10 (2)
41+	10 (2)
Race	

White	32 (8)
<i>Mestizo</i> ^a	20 (5)
Other	44 (11)
Not documented	4 (1)
Color	
White	52 (13)
<i>Trigueña</i> ^b	40 (10)
Not documented	8 (2)
Relationship Status	
Partnered	28 (7)
Married	68 (17)
Divorced (not remarried/partnered)	4 (1)
Education Level	
Some college	8 (2)
Associates degree	16 (4)
Bachelor's degree	5 (20)
Master's degree	40 (10)
Doctorate	12 (3)
Not documented	4 (1)
Socioeconomic status ^c	
Low-income	24 (6)
Middle-income	68 (17)
High-income	8 (2)
Insurance Type	
Private	64 (16)
Medicaid	20 (5)
Dually-insured (private and Medicaid)	4 (1)
Other	12 (3)
Pre-pregnancy BMI ^d	
Healthy (18.5 – 24.9)	60 (15)
Obese (≥ 30)	36 (9)
Not documented	4 (1)
Frequency of stress	
Never	28 (7)
Daily	24 (6)
Weekly	44 (11)
Planned Pregnancy	
Yes	56 (14)
No	20 (5)
Not documented ^e	24 (6)
Weeks pregnant at time of interview (n=14)	
0-13	7 (1)
14-26	36 (5)
27-40+	57 (8)

Primary prenatal care provider type	
Community-based ^f	36 (9)
Hospital-based	64 (16)
Gravida	
Nulliparous	60 (15)
Multiparous	40 (10)
<i>Multiparity (n=10)</i>	
1 - 2	80 (8)
2 - 4	20 (2)
<i>History of preterm birth (n=10)</i>	20 (2)
Planned location of delivery	
Community/Home	32 (8)
Hospital	64 (16)
Not documented	4 (1)

^a Indicates that the mother had mixed or multiple racial and/or ethnic identities.

^b A classification of *color* that is in between white and black (Gravlee, Dressler, and Bernard 2005; Godreau 2000).

^c Socioeconomic status was self-reported without pre-identified income values for each category.

^d BMI value ranges were established by the CDC (2017b).

^e Mothers were asked to indicate if their current or most recent pregnancy was planned since there were both pregnant and recently postpartum mothers represented in the study sample.

^f Community-based care indicates care outside of the hospital setting, at either a home or a birth center, with a midwife (Cheyney *et al.* 2019).

Four key themes were elicited from maternal narratives of stress during pregnancy: *Theme 1)*

“On top of our own skin”: Maternal stressors and overwhelming feelings; *Theme Two)* *“Scared to think of the future”*: Economic Precarity and Employment Exploitation; *Theme Three)* *“They don’t help you out”*: Stress Induced by Puerto Rican Institutions; and *Theme Four)* *“It’s your own responsibility”*: Mothers Responsibility for Preventing PTB and PNMS. Collectively these themes help to describe the interwoven nature of individual versus structural stressors of pregnancy in Puerto Rico, as well as the social expectations that shaped participants’ experiences of PNMS.

Theme One: “On top of our own skin”: Maternal stressors and overwhelming feelings

At the beginning of the interview, mothers were asked to describe what stress, in general, meant to them. Interviewees explained how the concept of stress was learned and embodied over the

course of their life experiences and that stress was experienced as feeling overwhelmed by the “imbalance” of managing work, family and a household. Mothers indicated that they felt overwhelmed because they were “desperate” to do “so many things at the same time”. Sitting with me at a Starbucks in swanky Condado, just a few blocks from one of our recruitment sites, Tonia, a first-time mom who identified as White, middle-income, privately-insured, married and employed part-time, explained how pregnancy causes daily obligations to become burdening stressors, saying: “...you do not have control of things [like pregnancy], so you are overwhelmed – you have a lot of work, more at home, and everything”. Sipping on her iced-coffee while sitting on a yellow, retro-1960s couch in the basement of a trendy “Pop-Up” shop in Santurce, a rapidly gentrifying sector of the San Juan area, Linda, a 32-year-old pregnant with her second baby, who identified as *trigueña* and was employed full-time as a clinic manager described the social consequences of appearing “out of control” and overwhelmed due to stress: “Stress is something that does not let you function, that can paralyze you, or that could embarrass you”. Overall, participant narratives described how stress during pregnancy is not only due to the herculean load of professional, personal and familial responsibilities that often fall to the mother, but also to the social stigma associated with appearing unable to manage these obligations. This balancing act could be witnessed in the everyday context, as I was continually impressed at the ways in which Puerto Rican women were well-dressed, calm, and confident despite knowing that they had incredibly hectic personal and professional lives.

Maternal stress was also equated with worry and was tightly connected to feelings of anxiety and fear about hypothetical or anticipated future challenges. Participants indicated that feelings of worry came from unexpected events that caused them to be “taken out of their comfort zone” and to be “on alert”, feelings that arose within the context of maternity care and in

their everyday life. In the field, as a clinic volunteer and student the pre-midwifery program that was taught by the co-founder of the community-based clinic, I was able to engage in conversations with mothers related to their worries often over cup of coffee or in the breezeway outside the clinic. Mothers' primary concerns were focused on their health, particularly for those who struggled or had a history of maternal morbidities such as gestational hypertension and diabetes. Among primiparous mothers and those with traumatic previous births there was the common concern about transitioning models of care in the event their morbidities became worse, meaning they would have to shift from a community-based to allopathic setting. In addition, there was also concerns associated with the labor and delivery itself and if they could "handle" the process of labor and delivery. For multiparous mothers, they identified caring for older children, issues associated with the school system and Puerto Rico's economic shifts as situations that kept them "on-edge". Overall, participants across the birthing experience spectrum acknowledged that family, work and finances were likely universal stressors and that it was an individual's context that shaped maternal perceptions of these stress experiences.

Participants also attributed high levels of negative emotions and stress to the "nature of Puerto Rican people" whom they described as being emotional rollercoasters, sensitive and passionate, as well as explosive and expressive. Mothers described such intense emotions and personality characteristics as a result of their embodying the intensity of living in a large, densely concentrated urban area with nearly all participants identifying "the people around you" as a primary source of stress in their lives. Sitting in the blasting air conditioning with her afterhours in the café at our second, community-based recruitment site, Xiomara, a 23-year-old second-time mother in the military, pregnant with her second child, summarized how the emotional ebbs and flows of the Puerto Rican people are a result of the larger environment:

“It’s [stress] everything. The temperature, the traffic, the people. We’re all so emotional and we’re always so on top of our skin. You will get very happy or very sad and depressed. We’re very emotional people, the Puerto Ricans so that’s why we cause the stress on each other [laughing].”

Living and working at the community-based center I personally witnessed how individual’s drastic emotional states were largely a result of the challenges of living in Puerto Rico.

Unexpected events were common, especially in the built environment. Frequent power and water outages, plumbing issues, poor road conditions, and low-quality repairs were commonplace on the island and made navigating daily life an inherently stressful process.

Theme Two: “Scared to think of the future”: Economic Precarity and Employment Exploitation

Economic insecurity during pregnancy caused participants to feel anxious about the potential of “unmanageable situations”. Interviewees described the ways Puerto Rico’s economic climate impacts wage-labor and employment opportunities, causing people to feel “stressed all the time” as low wage labor was abundantly available if one was willing to work long hours, a situation that is not amenable to individuals with or starting a family. Mothers described times when they did “not have money to pay the bills” due to adequate employment options, characterizing this as a common struggle related to “finding money and resources to survive the general stress”. Tonia sipped her tea and stared out the window into the bustling traffic of Calle de Diego, connecting her perception of stress in motherhood with the relationship between the island’s economic crisis, the absence of paid postpartum leave and the lack of equitable employment opportunities and social supports for women:

“Being a mother is very complicated. Being a mother changes your life and you have to make modifications to your job, you stop working, and then the stress comes, because you don’t have money. You have someone that depends on you...Terrible...The economic system, when countries are functioning and there’s no support - not for the mothers, no support for the people who are raising [children].”

Persistent feelings of worry were often a result of “dealing with rough circumstances” as mothers were “scared to think of the future” especially when it came to their jobs. Employment was described as a major stressor for mothers as multiple participants explained that in Puerto Rico one person often “does the job of three people”. For example, sitting with me at in a café at a cheap plastic table, surrounded by the humidity of a post-late summer storm, Victoria explained how working in a US corporate office located in Puerto Rico described how the island office did not implement certain employee benefits like half-day Fridays, even though employees were working 10 to 12 hours days at least four days a week. Due to political-economic inequities, limitations with federal funding, and a high unemployment rate, participants described trying to navigate the constant fear that “someone else will take the job”. One participant, who was a trained naturopathic physician described how her professional expertise was not a recognized, regulated profession on the island and was thus, unable to work to support her family though she was the primary income-earner when she lived prior in the continental-US. Interestingly, this individual also had deep insecurities about her body’s ability to birth despite her professional in holistic medicine and during our frequent conversations in the clinic, when I looked into her fearful eyes, I could not help but wonder how the insecurities of her family financially permeated other aspects of her life. Tucked away with me in one of the community center’s clinical rooms during an her interview, another individual aggressively described the unrealistic working load for secondary public school educators, who were expected to work more than 12 hours a day for little pay in a suffering educational infrastructure where students often come to “just to eat”. Participants stressed that if women refuse to work three jobs for the pay of one, there will always be another qualified person there who is willing, out of a desperate need to help support their family, to be exploited in this way. Working to change the conditions of their

employment to accommodate the demands of pregnancy and motherhood are quite simply not options.

Some participants discussed the stress of completing their work and the perceived impact that their pregnancy was having on their professional reputation. For these women, the workplace serves as a site for both support and additional stress. Natalie, a well-dressed 32-year-old first-time mom, who identified as mixed race and *trigueña* and was employed full-time as a pharmacist, held her newborn as she described how her colleagues (who were mostly women) encouraged her to reduce her stress at work, saying: “don’t stress, you are pregnant” and, as a result, often took on additional work for her. Other mothers felt an internalized sense of guilt, believing that their pregnancy impacted their productivity and that fellow co-workers perceived this as a burden. Victoria described that she worried that she left, “an unusually high workload for them [her colleagues], daily” and that not finishing her work “is one of the things that increases my [her] stress”. Several participants identified how employment was “not good” for pregnancy, describing how they felt conflicted over having to “work till the end”, yet they also did not feel good about passing their work on to other colleagues who they know are already overburdened working long hours for little pay.

Many women in both salaried and wage-labor positions described high-workloads with few or no breaks, making it difficult to balance hydration, nutrition and other physical necessities that are critical during pregnancy. Mothers explained that a lack of breaks at work and the subsequent stress it caused often resulted in “premature contractions” which meant, for some mothers, that they had to begin their maternity leave early, ultimately shortening the time they were able to spend at home after birth. These circumstances were especially threatening for mothers who struggled with additional pregnancy-related and/or preexisting medical

complications, such as elevated body mass index (BMI) or gestational diabetes. Sitting in the *Condado Plaza* as her three-month-old bounced happily on her lap and my eight-month-old cruised the outdoor furniture, Yara, an incredibly calm, 37-year-old first time mother who was a former instructor at a private college, explained how the stress of her job caused her to go on early maternity leave due to lack of breaks, flexibility and ultimately, the frequency of her premature contractions:

“I had premature contractions...and it was [caused by] the stress. Like, that lifestyle, made me feel that I had no time to eat, to rest, [and] I had many classes. Well, it provoked contractions before it was time...and my gynecologist made me a document that I could go on maternity leave early”.

Yara’s reflection, like other participants, is characteristic of those who had access to employment opportunities and yet, were exploited by a capitalist work structure. Desperate to keep their jobs even as members in the higher echelons of socioeconomic status in Puerto Rico, these mothers overworked themselves to prove their worth as an employee by “compensating” for their pregnancy and also to increase the likelihood that they would have a job when they returned from their unpaid parental leave.

Theme Three: “They don’t help you out”: Stress Induced by Puerto Rican Institutions

Mothers described stress in Puerto Rico as “accelerated” or heightened due to infrastructural and bureaucratic inequities. Participants provided numerous examples of how a weak, often-corrupt and ineffective government infrastructure contributed to feelings of powerlessness and stress in their daily lives, particularly in pregnancy. Paola, a petite, visibly stressed woman sitting across from me, refusing to make eye contact but eager to share her story, was a 32-year-old second-time mother of mixed race and White *color* who has a master’s degree, is unemployed and on Medicaid. When thinking about stress management and causes, Paola described how systemic causes of stress supersede her ability to manage her PNMS: “...there are measures that we can

take to calm [down from stress]. And there are others [stressors] that, regrettably are social, in the hands of someone else— and by this, I mean the government”. Echoing this sentiment, Luisa a 34-year-old first-time mother and graduate student described how frustrations with the Puerto Rican government are not only caused by a lack of services, but also by the informal routes in which services are accessed. Sitting together in a café outside the movie theatre at *Plaza de Las Americas* Luisa described how in Puerto Rico, consistent and reliable access to any services was the result of who you know and who had inside connections to getting things done – a form of informal network building that I observed frequently. Luisa described the stresses associated with the local government in Puerto Rico and how they contribute to this frustrating informal networking system:

“Government—they don’t help you out to get things done. Everything is hard to come by, because there’s ways of doing it, but they’re not going to let you know, it’s like hidden. Only the people who look for it and actually ask questions and go through the system the way they’re not supposed to are going to find out how to do things. People do things the other way around here.”

Mothers tied larger infrastructural deficits within the government to the quality of maternity care there were able to access. Some participants explained that, to their surprise, the provider whom they used for well-woman care did not provide obstetric services, forcing them to find a new physician (or more rarely, a midwife) for their pregnancy care. Participants described the ways biomedical providers who served privately insured clients charged additional, out-of-pocket fees and would threaten to terminate care for patients who contested the additional costs. Luisa described her experience with a new maternity care provider after she learned that her regular gynecologist was not accepting pregnant clients:

“He [the obstetrician] offered us a package of...a list of things. And we had to pay 500 dollars. But, when I look at the list of things, it’s like the gel warmer for the gel that they use for the sonogram and I’m like...why are you charging me for the gel warmer? Why are you charging me for both of the TVs you have in your

lobby waiting room? Why are you charging me for the belts that monitor the heartbeat? The hospital gives you that. I'm not going to pay you for your television monitor, your office, and a 4D sonogram and a whole bunch of other things. A change of sheets, the hospital room, Wi-Fi, cable."

Later, when Luisa approached the clinic secretary regarding the additional fees, she realized that her care was contingent upon this payment: "And she [clinic secretary] said 'Well you know, in the case that the patient cannot pay the 500 dollars, we will just give them their records.' And I know how to read between the lines." Luisa's experience demonstrates the limitations and resulting violence that occurs due to the structural deficits of the Puerto Rican maternity care system. Puerto Rico currently has a shortage of gynecologists who also provide obstetrical services in more than two-third of the island's counties (Kaiser Family Foundation 2018; Levis-Peralta *et al.* 2016). This is a result of insufficient reimbursement for health care services due to the federal health insurance capitation rate that has not been adjusted since 1968 (Mulligan 2014). Given the limitations in health insurance reimbursement, providers end up charging privately insured clients additional fees to compensate for the costs associated with running a practice. With a limited number of obstetrical providers on the island and the complexities around government-based and hospital-specific health insurance plans, most patients will pay the additional fee even though it is not legally required to receive services.

Theme Four) "It's your own responsibility": Mothers Responsibility for Preventing PTB and PNMS

Irrespective of the stressors that were novel or exacerbated during pregnancy, mothers felt that the it was the responsibility of the mother herself to manage her stress and that unmanaged stress was a threat to the developing fetus. Linda, reflects for a moment when being asked about stress management and then sits up tall and responds with a stern disposition, describing the expectation that mothers should take control of their own stress:

“By yourself. It’s your own responsibility, it’s your own duty because you are the one who decides to take it or avoid it. So, if you work with yourself, if you are in balance, if you are in control, you will reduce, or you won’t be at stress. So, it’s a commitment with yourself.”

Linda’s words, along with other similar participant narratives, revealed that part of managing one’s stress involved “organizing their finances, their life”, to remove individuals who were “stressing you out” with unwarranted advice, and to believe in the “protection of God” in situations where stressful or negative circumstances are unavoidable. Mothers also discussed stress management techniques including exercise, going to the beach, prayer, and talking with trusted family members.

Interestingly, for participants in this study, immediate and extended family members were simultaneously perceived as a source of critical direct support and as major stressors themselves. Mothers ‘described feeling the pressure of “constantly being watched” and needing to perform being “in control”. Immediate and extended families worried for the “pregnancy and the health of the baby,” especially when the mother was perceived as being stressed or in poor health. Partners were often considered sources of essential support for women to destress, while at the same time being described as anxiously “watching from the outside”. Camila, an elegant 41-year-old first-time mother who identified as a White (racially and in terms of *color*), and high-income calmly summarized how maternal stress can become a family affair as she struggled to latch her nursing newborn during the interview: “The whole family [gets stressed]. Because everybody worries about, you know, the pregnancy and the health of the baby. Anybody who cares about the baby is going to be affected if the baby is affected by stress”.

The expectation that pregnant individuals manage their own stress manifested primarily in one of two ways: 1) participants treated pregnancy as a buffer to stress, describing it as a time wherein they did not allow themselves to be affected by stressful situations or circumstances in

their life, or 2) mothers felt “guilty” because they could not control their stress and feared this could “harm the baby”. Individuals who perceived pregnancy as a buffer to stress, believed that pregnancy was a socially sanctioned time where they were excused from dealing with unnecessary stressors. These participants were also more likely to be higher-income and to engage in more self-care, describing their approach to deflecting stress during pregnancy as being “fluid” and “going with the flow”. For other mothers, the weight of such pressure to maintain a low stress pregnancy was particularly difficult due to limited social supports and numerous compounding stressors. These participants described attempting to ignore rather than manage their stress but explained how the vigilant state of pregnancy “put the stress right back into my consciousness” producing what some called a “tight belly.” As she gently stroked her 33-week pregnant belly, Paola summarized her struggle to contend with numerous pregnancy-specific and more generalized stressors, causing her to feel an overwhelming sense of guilt about the potential impact her stress was having on her unborn baby:

“I have made a large effort to avoid stress... Adapting to my husband, to a house, to the economics, losing my job, being sick, [hoping that] all of that doesn't affect her [the baby]. But...this pregnancy is different than the first...And I have been having more health difficulties. I feel that when I am going through a stressful moment and I try to relax, say to myself ‘you are pregnant, breath, remember that it can harm the baby.’ It's not only stress, because if I sometimes get stressed there are times that I also get angry. And having stress and with anger, I have noticed that the belly and the baby start to move and after it's difficult because I feel bad, I feel guilty. Because I want to control it, but I can't.”

Maternal perceptions of stress' impact on labor and delivery suggest that some Puerto Rican mothers see a relationship between maternal stress and the timing of delivery. However, the mechanisms of this relationship were elusive. Mothers described how stress can ultimately determine “if the baby wants to come or not” with many identifying a connection between prenatal stress and preterm birth. Jaslene, a self-identified high-strung, 34 year-old first-time

mother who was experiencing significant financial difficulties after she left her job as an educator due to the stress of the work, described how she believes stress caused her early delivery despite being told by her providers that other physiological factors may have been involved:

“After having a premature baby, I have learned that yes, it [stress] really does affect me and my baby. I had a premature baby and I’m pretty sure it [preterm birth] was that [caused by stress] ...If we add that to the money situation, the living situation, yeah, I think that’s the reason why I have a premature baby.”

Jaslene’s experience, juxtaposed with more relaxed and privileged mothers, demonstrates how sentiments of stress are often the result of larger issues related to one’s socioeconomic circumstances and cultural, gendered expectations related to stress management. Interviewees perceived that stress was an individual problem with individual-level solutions despite recognizing the structural limitations that made daily life in Puerto Rico challenging and stress-inducing. The neoliberal sentiment to control is echoed in the expectations of mothers, some of which ultimately internalize their maternal stress as a failure to maintain a healthy pregnancy.

Discussion

Participants narratives explained how PNMS is largely attributed to experiences related to varying degrees of economic inequity as it impacted Puerto Rican intuitions, their personal and professional lives as well as their pregnancy. Interviewees with higher levels of social support tended to perceive stress as an optional or occasional experience, but despite this privilege, recognized how economic and social expectations, particularly from co-workers and family members, are stress inducing. Participants also identified the ways in which the Puerto Rican context was inherently stressful, a dynamic that is largely a result of structural inequities that lead to increased bureaucracy, poor basic infrastructure and a dysfunctional maternity care system. Interestingly, maternal narratives illustrate how within the context of unreliable

institutions, individuals become reproducers of social inequities that perpetuated in a top-down fashion by Puerto Rican intuitions, the maternity care system, society, families and mothers themselves. Given this acknowledgement of the structural inequities in Puerto Rico, I ask: how do institutional, societal, and personal stressors uniquely contribute to MIH outcomes in Puerto Rico?

Puerto Rican mothers' perceptions and experiences are similar to populations in the US states (Bermúdez-Millán *et al.* 2011); emphasizing general feelings of being overwhelmed and worried – however, this stress was magnified by structural limitations in a neo-colonial context. Mothers explained that stress, in general, was primarily due to the complex intersection of gender-based inequities known in the social science and feminist literature as the “double-burden of motherhood” in the neoliberal era, where the expectation of managing work and family life obligations disproportionately falls to the mother (Albelda 2005; St. Jean and Feagin 2015). Bermúdez-Millán *et al.*'s (2011) qualitative research with Puerto Rican women living in the US states shows that maternal perceptions of stress were similar to the mothers in this study, with subsequent research suggesting a relationship between elevated maternal stress and poor birth outcomes including preterm birth and low birthweight (Szegda *et al.* 2018). Given the similarities in perceived stress and the persistent differences in birth outcomes such as preterm birth, I question what is unique about Puerto Ricans or the Puerto Rican context that results in poor MIH outcomes?

The primary cause of PNMS, identified by Puerto Rican mothers, was financial precarity, both in terms of the island's economic situation and in their individual lives – an unsurprising finding, as women have been at the center of insular economic development efforts since World War II (López 2008). During this study, the Puerto Rican government

defaulted on a 70-billion-dollar debt eliminating access to capital markets. The Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA) board failed to develop a viable economic plan to assist with the island's debt, further tightening economic circumstances for the local government (Perreira *et al.* 2017). Mothers experienced severe PNMS related to the prospect of losing their jobs and the financial well-being of their families, particularly when they perceived their pregnancy as impacting their ability to be a productive employee. Eick *et al.* (2018) identified that in Puerto Rico, unemployment was common among women who delivered preterm, calling into question how economic inequities, as experienced by Puerto Rican women, contribute to poor MIH outcomes.

Mothers experiences of PNMS revealed how political-economic inequities impact the provision of maternity care and how institutional oppression manifests within the context of the clinical encounter. Puerto Rico's for-profit biomedical system, which emulates the health system in the US states, does not function optimally due to a number of political-economic structural constraints (*see* Horan and Cheyney, forthcoming) and thus, has created a system in which maternity care has become further commodified, hierarchically-structured and exclusive at the emotional and financial expense of the pregnant individual. Luisa's experience highlights how health system inequities, such as low-health insurance reimbursement rates for providers and a deficit of maternity care providers on the island, has shaped the availability and provision of maternity care services – placing the financial burden on mothers to pay additional out of pocket costs for their services. This form of provider-related stress is unique to the Puerto Rican context and is the direct result of constraints caused by colonization, as providers and mothers engage in coercive, informal payment methods to compensate for explicit, institutional inequities.

At the familial level, Puerto Rican mothers identified a conflicted disposition regarding PNMS and support, demonstrating the complex intersection of *Latinx/Hispanic* cultural values and the island's cultural proximity to the US states. *Latinx/Hispanic* cultures are understood to have three fundamental core values: *familismo* (familism), *respeto* (respect) and *educación* (moral education) (Halgunseth, Ispa, and Rudy 2006); with the first two of these core cultural values documented in Puerto Rican populations (Cortés, Rogler, and Malgady 1994). *Familismo* is the desire to maintain a strong, practical and emotional family support network by prioritizing family needs over oneself (Halgunseth, Ispa, and Rudy 2006), a value that has been decreasing across generations and with socioeconomic mobility in Puerto Rican populations (Cortés 1995; Rogler *et al.* 1985). *Respeto*, a cultural value of respect that is contingent upon one's role in the family, is more common in low-income Puerto Rican families (Harwood *et al.* 1996). Puerto Ricans are characterized as being *bicultural* (Barcelona de Mendoza *et al.*, 2016; Hunt, Schneider, and Comer 2004; López and Contreras 2005) and demographically, mothers represented a higher-income population than what is characteristic of the island at large, with several participants having lived in the US states for some portion of their lives – experiences that likely influenced their perception of family support. Though Puerto Rican mothers never referred to these cultural values explicitly, their narratives, such as Jaslene's, of family, stress and pregnancy indicate how core cultural values common in *Latinx/Hispanic* cultures, served as a significant source of PNMS. In addition to expanding our understanding of family dynamics as a maternal stressor, future investigations should consider the role of paternal identity and the way this shapes perception of maternal stress to build upon an area of research that has potentially identified a novel stressor within the family unit (Arroyo 2013).

Beliefs of individualism and health – a public health paradigm employed in the US biomedical system – was reflected in mothers' perception of stress and its relationship to poor birth outcomes. Mothers in this study demonstrated a strong disposition towards personal responsibility and the individual management of stress during pregnancy; a form of hostility known as mother (or victim)-blaming (Caplan 2013). Maternal narratives related to stress and pregnancy in Puerto Rico indicate that poor infant health outcomes, such as PTB, are primarily the fault of the mother. For some participants, this responsibility served as an imperative for improving their health. For others, such perceptions served as an additional form of PNMS for mother causing them to feel guilt or powerlessness –as they simultaneously served as the accuser and the embodied victim of maternal stress as perpetuated by Puerto Rican institutions, society, family, and the pregnant individual themselves. Individualism and social upward mobility permeate participant narratives as pregnancy is seen as no exception to the personal responsibility crusade characteristic of contemporary Puerto Rican motherhood.

The Puerto Rican health disadvantage framework (Britton and Vélez 2015; Roy, Hughes, and Yoshikawa 2013) calls attention to inequities experienced by this population while also further stigmatizing Puerto Rican bodies. The impact of maternal stress on MIH outcomes, particularly in the US states, has an associative relationship between acculturation, discrimination, and outcomes such as gestational hypertension, PTB and low birthweight (David and Collins 2007; Fleuriet and Sunil 2017; Frey and Kelbanoff 2016; Jackson *et al.* 2001; Vogel *et al.* 2018). For Puerto Ricans, who are not immigrants and not solely Black or White, but who are ancestrally, culturally and linguistically divergent from populations in the US states, such associations should be nuanced and considered within the context of biculturality and neo-colonization. Previous research has demonstrated that common epidemiological factors

associated with PTB in the US states (Cordero 2013). While these findings are critical to understanding the pregnancy-maternal stress-preterm birth nexus, this information also risks contributing to hypotheses of genetic determinism, insinuating that there is something unique about being Puerto Rico or the Puerto Rican context related to poor MIH outcomes. When health inequities with limited data are described in ways such as the Puerto Rican health disadvantage, I argue that colonial forces are devoid of responsibility in the perpetuation of the existence and masking of the health inequities experience uniquely by Puerto Rican populations.

Conclusion

In medical anthropology and related-fields, there is a deficit of research focused on the lived-experiences of stress, pregnancy, and prematurity as self-reported qualitatively from pregnant individuals. Mothers in this study contextualized PNMS in Puerto Rico during the childbearing year, and in my analysis of this work, I argue that their perceptions of stress draw attention to how the embodiment of stress during pregnancy is a top-down process. Maternal narratives reflected the ways in which colonial structures impact health care institutions and provider practice as well as societal and individual beliefs around stress and pregnancy that are heavily embedded in the discourse of personal responsibility. The Puerto Rican health disadvantage framework highlight disparities in Puerto Rican populations, unique from other *Latinx/Hispanic* populations, however this concept risks stigmatizing the biologies of Puerto Rican people due to the lack of data capturing how structural forces permeate to the individual. Collectively, the limited but critical research on maternal perceptions of stress and pregnancy demonstrate the importance of anthropological, ethnographic and qualitative data as tools for understanding the complex ways in which human maternal stress becomes a clinical etiology of in the complex pathways of understanding birth outcomes such as PTB.

Notes

ⁱ Due to uncertainty that can present when classifying a PTB as spontaneous or indicated (see Frey and Klebanoff 2016), a new classification has been developed. This classification is called the phenotype of PTB and is defined as “biochemical and physical characteristics of the mother, fetus, and/or placenta that lead to and/or are present at the time of delivery” (2016:71). This approach was designed to reduce assumptions related to “underlying etiologies” (71) and focuses on characteristics of PTB that are easier to identify. This approach is more specific than the original spontaneous versus indicated classification system – it is recognized that each phenotype has “multiple underlying etiologic pathways” and that multiple phenotypes could cluster together for one patient (71). The Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Genomic and Proteomic Network for Preterm Birth Research (GPN) has identified a number of phenotypes for PTB including: maternal stress, premature membrane rupture, familial factors, maternal comorbidities, and infection/decidual hemorrhage/placental dysfunction (Esplin *et al.* 2015; Manuck *et al.* 2015).

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Chapter Four: “There are just no boundaries” – ZIKV as a Compounding Prenatal Stressor in Puerto Rico

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Abstract

Objective. To examine the impact of the 2016 ZIKV crisis on women's experiences of pre- and perinatal stress.

Methods. Twenty-three women, either pregnant or within six weeks postpartum, completed an eligibility questionnaire which included demographic, reproductive health history and general health history questions. Participants also engaged in a qualitative, semi-structured interview designed to contextualize the experience of stress and pregnancy in Puerto Rico.

Results. Twenty-three pregnant (n=12) and recently postpartum (n=11) Puerto Rican women completed the eligibility questionnaire. Four key themes related to stress, pregnancy, and ZIKV emerged from the mothers' narratives: 1) "There are just no boundaries": Family, Decision Making, and Gender-Based Stress; 2) "Every day I think that it was invented": Zika as a government conspiracy; 3) "I worried about mosquitos all the time": Fear of ZIKV-related birth defects; and 4) "What am I going to do?": ZIKV as a compounding maternal stressor. Key themes, as described in the participants' interviews, were both deeply interconnected and contradictory, providing unique, individual examples of how these stressors impacted their perception and response to ZIKV during their pregnancy.

Conclusion. Maternal narratives pre- and perinatal stress illustrate that ZIKV exacerbated the effects of daily stressors and that perceptions and health behaviors associated with the virus were influenced by Puerto Rico's colonial reproductive history. Public health messaging across the island was perceived as being insufficient for mothers, and in response, they focused on immediate, tangible life stressors that served as an equal if not greater threat to the health of their pregnancy.

Introduction

By 2016, Puerto Rico accounted for 85 percent of all clinically diagnosed Zika virus (ZIKV) infections in the US jurisdiction. Puerto Rico also had the first reported ZIKV-associated case of microcephaly in the US.^{1,2} ZIKV's primary mode of transmission is mosquito-borne, and infection is generally mild in virulence compared to other common arboviruses in Puerto Rico like dengue fever and chikungunya. However, the ability of the ZIKV to transmit vertically from mother to fetus during pregnancy places women at increased risk for poor fetal and infant health outcomes, including: fetal loss, microcephaly, brain abnormalities, abnormal eye development, hearing loss, musculoskeletal disorders, and central nervous system dysfunction.²⁻⁴ As such, the ZIKV threat led to aggressive public health messaging in Puerto Rico that focused on infection reduction by promoting both short- and long-term contraception with the intent of delaying childbearing.⁵

Puerto Rico has experienced centuries of colonial rule⁶⁻⁸ resulting in political and economic disparities. In addition, covert and overt racism, classism and xenophobia, have been used to justify aggressive, experimental “reproductive health” programs in the form of forced sterilization and unconsented high-dose hormonal birth control. Given this history, perhaps not surprisingly, public health messages aimed at convincing women to prevent or delay childbearing in the face of the ZIKV threat were met with skepticism and mistrust. At the height of the ZIKV epidemic in Puerto Rico in August of 2016, we completed 25 open-ended, semi-structured interviews with pregnant and recently delivered women as part of a larger research project aimed at assessing the effects of maternal stress on preterm birth rates on the island. The purpose of the portion of the project presented here was to examine the impact of the 2016 ZIKV crisis on women's experiences of pre- and perinatal stress.

Methods

Data collection for the larger, two-phase study occurred during 16 months of fieldwork, split into two time periods (14 months and two months, respectively) between August 2016 and March 2018. In phase I (August 2016 to November 2016), we employed the use of two qualitative methodologies: multi-sited participant observation and open-ended, semi-structured interviews.⁹ From August to September 2016, the first and third author engaged in multi-sited participant observation which allowed for the creation of a systematic record of day-to-day interactions, observations, and informal conversations through field notes.⁹ The first author spent the entire fieldwork period engaged in participant observation, documenting what she observed to elicit an essential background context for better understanding ZIKV as a pregnancy stressor in Puerto Rico.

Twenty-five women, over the age of 17 years, who were either pregnant or within six weeks postpartum, were recruited using non-probability quota sampling⁹ from a local maternal and infant health community-based organization and a hospital-based non-profit breastfeeding support group in San Juan, Puerto Rico. Participating mothers were recruited to provide semi-structured interviews designed to contextualize the experience of stress and pregnancy in Puerto Rico. All study materials were available in English and Spanish. This project was approved by the Institutional Review Board of Oregon State University in April of 2016.

Upon providing verbal consent, participants completed a three-section eligibility questionnaire. The first section elicited basic demographic information such as the mothers' sex, age, marital status, race, ethnicity, the unique Puerto Rican social classification known as *color*,¹⁰ length of residence in Puerto Rico, citizenship status, education level, income-level and occupation. The second section contained general and psychosocial health information including:

health insurance type, smoking status and current stress levels. The third section, “Pregnancy Questions”, was used to determine eligibility for the study and included questions such as “Are you pregnant?”, “How many weeks pregnant are you?”, as well as specific information about their prenatal care services and reproductive health history. Pre-pregnancy weight and height were also self-reported by participants allowing us to calculate pre-pregnancy body mass index (BMI).

The first and third authors co-conducted semi-structured interviews in-person or by telephone. Interviews were carried out in Spanish (n=16) and English (n=7) between August and September of 2016. The interview guide was translated and back translated in Spanish in order to promote consistency between the English and Spanish versions of the interview questions. Interviews were audio recorded with the mothers’ consent, de-identified and transcribed verbatim. Interviews conducted in Spanish were transcribed and then translated into English and reviewed again by the each of the authors. Interviews ranged from 10 minutes to one hour in length, with an average interview duration of approximately 30 minutes.

After conducting the first four interviews, we were surprised that ZIKV was not explicitly identified as a stressor of pregnancy, given that the ZIKV epidemic was declared a public health emergency in Puerto Rico just as our study began. We decided to expressly prompt participants about the role of ZIKV as a stressor of pregnancy at the end of the interview if this topic did not emerge at any point prior. The first four mothers, who did not receive this prompting, were subsequently e-mailed the question “How has the Zika crisis affected your pregnancy?”. The email asked for the participant’s consent to include their response in their official transcript. Two of the four emailed mothers responded, resulting in 23 individual narratives that discussed how ZIKV impacted their experiences of stress during pregnancy. Authors consensus coded the

interview narratives, identifying representative, recurring themes that described mothers' experiences related to ZIKV, stress, and pregnancy.¹¹

Results

Twenty-three pregnant (n=12) and recently postpartum (n=11) Puerto Rican women completed the eligibility questionnaire (see Table 4.1). Mothers who were pregnant during the interview represented all three trimesters of pregnancy.

Table 4.1 Select Demographic, General Health and Maternal Reproductive Health Characteristics (N=23)

Characteristic	%(n)
Pregnant	
No	48 (11)
Yes	52 (12)
Age	
18-24	9 (2)
25-30	21 (5)
31-35	52 (12)
35-40	9 (2)
41+	9 (2)
Race	
White	31 (7)
<i>Mestizo</i> ^a	21 (5)
Other	43 (10)
Not documented	5 (1)
Color	
White	48 (11)
<i>Trigueña</i> ^b	43 (10)
Not documented	9 (2)
Relationship Status	
Partnered	26 (6)
Married	69 (16)
Divorced (not remarried/partnered)	5 (1)
Education Level	
Some college	5 (1)
Associates degree	17 (4)
Bachelors degree	21 (5)
Masters degree	39 (9)

Doctorate	13 (3)
Not documented	5 (1)
Socioeconomic status^c	
Low-income	21 (5)
Middle-income	69 (16)
High-income	9 (2)
Insurance Type	
Private	65 (15)
Medicaid	17 (4)
Dually-insured (private and Medicaid)	5 (1)
Other	13 (3)
Pre-pregnancy BMI^d	
Healthy (18.5 – 24.9)	61 (14)
Obese (≥ 30)	35 (8)
Not documented	5 (1)
Frequency of stress	
Never	31 (7)
Daily	26 (6)
Weekly	39 (9)
Not documented	5 (1)
Planned Pregnancy	
Yes	56 (13)
No	17 (4)
Not documented ^e	26 (6)
Weeks pregnant at time of interview (n=12)	
0-13	9 (1)
14-26	42 (5)
27-40+	50 (6)
Primary prenatal care provider type	
Community-based ^f	31 (7)
Hospital-based	69 (16)
Gravida	
Nulliparous	61 (14)
Multiparous	39 (9)
<i>Multiparity (n=9)</i>	
1- 2	78 (7)
2 - 4	22 (2)
<i>History of preterm birth^g (n=10)</i>	20 (2)
Planned location of delivery	
Community	26 (6)
Hospital	70 (16)
Not documented	5 (1)

^aIndicates that the mother had mixed or multiple racial and/or ethnic identities.

^b A classification of *color* that is in between white and black and is dependent upon various other social and economic contexts.^{10,12}

^c Socioeconomic status was self-reported without pre-identified income values for each category.

^d BMI values were established by the Centers for Disease Control and Prevention (CDC).¹³

^e Mothers were asked to indicate if their current or most recent pregnancy was planned since both pregnant and recently postpartum individuals were represented in the study sample.

^f Community-based care indicates care outside of the hospital setting, at either a home or a birth center, with a midwife.¹⁴

^g Preterm birth is a birth before 37 weeks gestational age.¹⁵

Four key themes related to stress, pregnancy, and ZIKV emerged from the mothers' narratives: 1) *"There are just no boundaries": Family, Decision Making, and Gender-Based Stress*; 2) *"Every day I think that it was invented": Zika as a government conspiracy*; 3) *"I worried about mosquitos all the time": Fear of ZIKV-related birth defects*; and 4) *"What am I going to do?": ZIKV as a compounding maternal stressor*. Key themes, as described in the participants' interviews, were both deeply interconnected and contradictory, providing unique, individual examples of how these stressors impacted their perception and response to ZIKV during their pregnancy.

"There are just no boundaries": Family, Decision Making, and Gender-Based Stress

Mothers were asked to discuss how stress in Puerto Rico compared to stress experienced elsewhere in other US states or other parts of the Caribbean. Participants described stressors that they argued were unique to Puerto Rican culture, and the ways in which local cultural values increased their stress related to ZIKV. Xiomara, a 23-year-old second-time mother in the military pregnant with her second child, compared her experiences living in Puerto Rico to the continental US, describing the stress associated with family, particularly during pregnancy:

"I moved back to Maryland, and there you don't have to deal with family, you don't have to deal with Puerto Ricans having opinions over everything you do in your life...you don't have that pressure of family giving their opinions like they do in Puerto Rico where everyone is in your business and putting pressure on you. Everyone wants to tell you what to do about Zika."

By relocating away from family, this mother felt some relief from the social pressure and the intimacy of decision making around pregnancy, birth and child-rearing that often occurs between the mother, her partner, and members of the extended family.

Jaslene who had recently returned to Puerto Rico to start a family after spending several years working in Florida, spoke of the stress that resulted from her family and their desire to be involved in decision-making related to pregnancy and ZIKV:

“Family here, culturally, families are very, very close here, and they all get in your business. They mean well, and they all love you, but there are no boundaries. So, you are bombarded with their problems and they want to be [in] your life and make decisions that you should be making. Their worry for Zika becomes your worry for Zika. They all mean well but it’s, it’s a mess. I love them, but this is my life, and this is your life, and there are just no boundaries.”

Mothers who spoke about Puerto Rican family values and the stressors that can result from them had often spent time in continental US. By comparing their experiences on the island to those in the US states, they were able to discern familial relationships as sometimes problematic and stress-inducing – a common sentiment as many interviewees described their stress as coming from “people around you.” Mothers highlighted that Puerto Ricans, especially women, give “a lot of importance to what other people think” including when it came to medical and reproductive decision-making. The ZIKV crisis was seen as providing yet another opportunity for families to offer unsolicited advice and recommendations. By in large, participants felt that gender-based stress in addition to overbearing familial and decision-making tensions were exacerbated during the ZIKV crisis, making pregnancy an overwhelmingly emotional experience.

“Every day I think that it was invented”: Zika as a government conspiracy

The theme of ZIKV as government conspiracy emerged largely around an explicit lack of faith in the local Puerto Rican government and a profound skepticism over US public health entities' (like the Centers for Disease Control and Prevention (CDC)) intentions. The latter's historical and contemporary colonial relationship with Puerto Rico and the history of what many see as the USs' anti-natalist policies towards Puerto Rico combine to produce significant distrust around ZIKV messaging. Mothers described feelings of uncertainty and wariness that led them to question whether the ZIKV threat was "even real." As a post-sterilization society,⁶⁻⁸ many Puerto Rican women are skeptical of any health campaigns supported by the US government, especially when it aims to curb reproduction. Celeste, a birth activist and community leader, reflects: "So, we have had other mosquito-borne illness for a long time, like dengue and chikungunya, and now all of a sudden we should delay childbearing and tourists should not come here. Right...this is suspicious to us." Thinking of ZIKV as a fabricated threat allowed Julia, pregnant with her second child, to reduce stress on herself and her family. When describing her daughter's concerns, Jenna, a physical therapist pregnant with her second baby, said: "She [her daughter] goes, 'mama take care of yourself, of the Zika.' And I just assured her, 'Baby, that was made up by humans, for political reasons, so don't worry about Zika.'"

In response to rising ZIKV diagnoses, a local association of obstetricians and gynecologists initiated a program that offered free contraception to any individual wanting to delay pregnancy; options included a variety of long-lasting forms, as well as oral contraceptives and condoms.⁵ Despite the advertised intent to empower women through reproductive decision-making, this program increased Puerto Rican women's suspicions about ZIKV, particularly relative to a community-based program in neighboring Cuba that was a leader in successfully

eradicating ZIKVⁱⁱ by prioritizing basic public health measures including the elimination of standing water sites.^{16,17}

In addition to a deep history of reproductive oppression, much of the skepticism around ZIKV was related to how information was dispersed by the media. Some mothers argued that they needed access to “unbiased information” but that this was nearly impossible to find in Puerto Rico. Linda, a 32-year-old mother pregnant with her second baby, who identified as *trigueña* and was employed full-time as a clinic manager, shared her perspective about how information is distributed on the island, particularly when it came to clinical testing and information related the incidence and prevalence of ZIKV on the island:

“It’s not the same to give you information without any emotional aspect of my own opinion, to give you information just to educate yourself, or allow you to make your own decisions. Here, we don’t do that. We just give you information in a way that makes you change your point of view to mine. So that part, the manipulation, that is what brings me stress.”

Liana, pregnant and in her first trimester with her first baby, argued that in combination with a lack of reliable information, the media’s portrayal of ZIKV is to blame for the local and global hysteria, saying: “The status of the country [Puerto Rico], everything makes you worry. Really, it’s the media. What they make of it [the Zika threat], that is the problem.” When watching the local news or driving on the major highways – one could see advertisements and billboards messages that had an image of a large mosquito biting human flesh that said “*si te pique, se complica*” (“if it bites you, it becomes complicated”). Aside from this doom and gloom messaging, these advertisements often had limited additional information on how to reduce local transmission and very few if any publicly displayed messages about preventing sexual or vertical transmission. Participants’ felt a sense of distrust related to how the media sensationalized Puerto Rico as a breeding ground for ZIKV when local, public health messaging

was largely ineffective for reducing transmission outside of the regular precautions, such as the use of mosquito repellent, that mothers already employed in their daily lives.

“I worried about mosquitos all the time”: Fear of ZIKV-related birth defects

Maternal narratives indicate, to varying degrees, a sense of conflict around the ZIKV scare; while many were skeptical of ZIKV public health messaging and the media, all were simultaneously concerned about having an infant with microcephaly – a risk that was nearly impossible to quantify. ZIKV-related stress and fear associated with birth defects co-existed alongside skepticism over whether the risks were being overstated as a means of population control. Maternal narratives reflected a deep distrust of both US and Puerto Rican public health institutions. Yet, at the same time, the threat of microcephaly, and its potentially life-altering consequences, were considered serious by most participants.

Though not all ZIKV-related educational initiatives were known or clearly understood by all participants, the message of the threat of birth defects had reached mothers loud and clear. The additional stress that mothers experienced because of the ZIKV threat was described as affecting their daily routines and schedules in a way that was undesirable and stressful. Coral, a 31-year old, first-time mother described how ZIKV contributed to the anxiety that her and her partner experienced during each ultrasound:

“It was very scary and frustrating that a mosquito would bite me. Every time that I would go do a sonogram, I wanted to make sure that the baby was well, that the baby was developing well, that the baby wouldn’t have problems...every time that [we had] a sonogram, my husband would be even more stressed than me. We needed to know that the head was the average measurement and that everything was going alright.”

Another first-time mother, Paz, who had a doctoral degree, spoke about her desire to give birth to a healthy baby as soon as possible: “That is a topic that has given me a lot of stress this pregnancy— Zika. In fact, I want to give birth already, to avoid exposing myself to the

disease... Well, I kind of want to give birth now. At least, I want the days to go by fast, so the baby doesn't come out affected." Participant's reliance on biomedical technologies such as ultrasounds and the desire to "give birth as soon as possible" are particularly concerning. In Puerto Rico, birth is highly-medically managed as is evidenced by the high rates of elective induction, preterm birth and NSTV cesarean section.¹⁸ Mothers concerns related to ZIKV and their trust in clinical technology served as a site of additional control and surveillance for the maternity care system – as mothers felt the only solution to their existing anxieties could be resolved through empirical evidence that the baby was "developing normally".

In addition to the monitoring of ZIKV – the availability of certain public health messaging in Spanish reflects mothers' concerns associated with a lack of reliable information. On the CDC's *Print Resources* page for ZIKV¹⁹ information on ZIKV basics, mosquito-bite prevention, and mosquito control are available in both English and Spanish. Useful documents available only in English include information on ZIKV and sexual transmission, when to get tested for ZIKV (for the general population), collection and submission of specimens for testing at time of birth, and the interpretation of test results for suspected ZIKV virus infection. Information on counseling travelers and what can be done in the event of a positive diagnosis were also exclusively available in English. At several rural locations in Puerto Rico – there were ZIKV preventions fliers posted that were in English only. The inaccessibility of this information for Spanish-speakers in Puerto Rico contributed to the sense of "insidious messaging" about who was really being protected from ZIKV. The absence of critical information in Spanish was also perceived as intentional withholding of information that could provide more knowledge to a population that was becoming increasingly concerned about the threat of microcephaly as the calculated incidence of ZIKV peaked at 12.9 percent in 2016.²⁰

“What am I going to do?”: ZIKV as a compounding maternal stressor

Mothers expressly described ZIKV as a lower priority than daily issues related to “finding money and resources to survive the general stress” of daily life. Many believed that ZIKV was potentially a threat to their health but viewed worrying about ZIKV as an unhealthy stressor in and of itself. Daya, a 30-year-old first-time mother, who was early in her second trimester when interviewed, highlighted the practicality of her approach to ZIKV stress saying: “You can do your part, but you cannot manipulate what will happen. How can you keep a mosquito from ever biting you in this environment? You can only do what you can do.” For her, the stress of “being preoccupied with something that you can’t change,” while living in a humid, tropical environment, was a greater threat to the pregnancy than ZIKV itself. Jessica, a stay-at-home mother with a master’s degree who was 33-weeks pregnant with her second baby at the time of the interview, described her frustration with the unrealistic expectations of ZIKV prevention beyond taking basic, local-transmission precautions: “What am I going to do? Put repellent on my face, go out with a bag [over my head], what am I going to do?”

While ZIKV-related stress certainly emerged as a common theme, it is also noteworthy that some never mentioned it as a stressor until specifically asked. Zulimar, a 37-year-old teacher in the early postpartum period with her first baby, reflected on the stress ZIKV caused in her pregnancy after being prompted: “Now that you mention it, you do not know if you are stung by a mosquito that has it [ZIKA], this also caused me a lot of stress.” This mother, like other mothers who worked outside of the home, reflected primarily on the stress of working long hours while pregnant, and the lack of adequate maternity leave policies. These were for her, by far, the biggest daily stressors. The focus on ZIKV was recognized by many as a way of diverting attention from the “bigger issues.”

Even though the ZIKV threat clearly affected maternal stress levels and added additional stressors to mothers' lives, it was not the primary concern for most mothers - instead other, more potentially modifiable and immediately threatening issues served as primary stressors for pregnant Puerto Rican women like poverty, underemployment, traffic, urban congestion, pollution, low quality, yet expensive food, and contaminated water.¹⁸ Mothers were acutely aware of the political and economic changes related to Puerto Rico's defaulted 70 billion dollar debt and the subsequent financial oversight of the island²¹ which left many feeling vulnerable as they anticipated cuts to education, health care, employment as well as a potential change in the island's status as a territory that would result in either statehood or independence – neither of which was perceived as an “ideal option”. Maternal narratives indicate that stress in Puerto Rico flows from numerous sources and ZIKV is only one of them. Feelings of political and economic powerlessness and economic precarity are far more central to women's stress narratives. June, a 24-year-old unemployed individual in her third trimester, summarized this concern: “Sometimes the stress is related to the burden of not knowing what is going to happen next here. How will we continue to survive?”

Discussion

Participant narratives contextualizing maternal stress in Puerto Rico describe how ZIKV serves as a conflicting and compounding stressor; a perspective that is shaped by the island's colonial reproductive history, social expectations, and on-going political-economic crisis. The impact of ZIKV on mothers' stress levels was caused not only by a fear of birth defects, but also by feeling out-of-control, with a lack of reliable clinical information related to transmission, risk and testing and the unlikely possibility that they could avoid all contact with mosquitos in a Caribbean environment for the entire duration of their pregnancy, especially before they knew

they were pregnant. It is important to note that these interviews occurred prior to the two major hurricanes, Irma and Maria, which devastated the island on September 6th and September 20th, 2017. Participants in this study had no way of knowing what was to come, nor how much more precarious their situation would be the following year.²²

For this study, we employed a critical medical anthropology framework to examine the roles of power and structural inequities in shaping maternal perceptions of stress in pregnancy within the Puerto Rican context.²³ Maternal narratives reveal a more complex story about the experience of being pregnant at the height of the ZIKV epidemic and the ways in which concerns about ZIKV are intertwined with larger issues of political and economic precarity. Participants, by in large, were less concerned with the pathology of ZIKV infection itself and concerned about how the threat of ZIKV complicated the social inequities that mothers were already experiencing in their daily lives.

Participants' narratives make clear the ways Puerto Rico's colonial reproductive health history shaped perceptions of public health measures designed to "prevent" ZIKV infection. Our research identifies ZIKV as a postcolonial disorder - a condition or "disorder" that occurs as a result of the "haunting presence of colonial trauma" leading to the eruptions of a politically motivated "disorder" as mothers simultaneously resisted and accepted the threat of ZIKV during their pregnancies.⁴⁰ As such, findings from this study demonstrate how the simultaneous resistance and fear of ZIKV itself has the potential to worsen existing etiologies associated with maternal and poor MIH outcomes in Puerto Rico.

In addition to lack of clinical information, participants struggled to make sense of how Puerto Rico became an epidemic site of the ZIKV crisis – further contributing to their distrust in US and Puerto Rican public health institutions. During this study, nearly half of the entire

pregnant population in the US diagnosed with ZIKV were asymptomatic.²⁴ At the height of the ZIKV epidemic in Puerto Rico, first-trimester ZIKV testing was required though methods of laboratory testing have been called into question. The detection of ZIKV ribonucleic acid (RNA) in serologic samples provides a definitive ZIKV diagnosis; however, the viremia of ZIKV is variable, and a diagnosis using RNA is most accurate within a week after the onset of clinical symptoms.²⁴ Immunoglobulin M (IgM) methods are more reliable diagnostic tests in the weeks and months following a ZIKV infection,^{24,25} however, cross-reactivity of flavivirus antibodies lowers the reliability of serologic test results, particularly in areas where dengue is endemic. Refined testing techniques such as the plaque reduction neutralization test (PRNT)²⁵ are known to be the most specific test for discerning closely related flavivirus antibodies and can be used to verify results from IgM testing. Unfortunately, methodological complexities cause PRNT to be impractical in areas with a high volume of testing, leaving IgM methods to be the standard for ZIKV testing for all individuals who have had clinical symptoms for more than a week – despite the fact that diagnostic accuracy past seven days has not been determined.²⁶

Mothers' concerns associated with ZIKV illustrate complicated positionalities, navigating between political distrust emerging from the island's neo-colonial status and the sense of fear many felt around protecting their developing baby. Mothers typically relied on the biometrics of an ultrasound to reassure them that they were carrying a fetus without congenital anomalies—a routine practice for both hospital-based and community-based providers. While some researchers have argued that ultrasonography is not a highly sensitive method for detecting congenital anomalies such as microcephaly especially before 18 to 20 weeks gestational age,⁴⁴ for participants in this study, ultrasounds provided reassurance for those who conceived at the height

of the ZIKV epidemic. For families and providers alike, ultrasounds provided the closest thing to peace of mind they could hope for during the pregnancy.

The ways the ZIKV-threat has been culturally elaborated in Puerto Rico harkens to Scheper-Hughes and Lock's²⁸ concept of the *body politic* - wherein the relationship between individual women's pregnant bodies, the ZIKV threat, and the clinical "reassurance" of an ultrasound are symbolic of the need for power and control both for the provider and for the mother – particularly in a context where avoiding local transmission is nearly impossible. The imperative to control occurs when a community experiences a threat (i.e. ZIKV) and in response, expands the number of social controls regulating vulnerable bodies (i.e. pregnant women). Threats to the community (i.e. the transmission of ZIKV through mosquitoes, blood donation, intercourse, and maternal-to-fetal transmission) may infiltrate and pollute the inside (i.e. the fetus) of these vulnerable bodies which become the focus of regulation and surveillance.²⁹ During the ZIKV epidemic, mothers both adopted and resisted control measures throughout their pregnancy as they contended with immediate and arguably more significant life stressors. Complex and sometimes contradictory views of the ZIKV threat were shaped by information related to local histories, testing methods, maternity care practices, as well as the content and context of public health information.

Limitations

The mothers in this study sample were recruited from a largely middle-class, urban area, and as a result, have experiences and perceptions that likely do not represent the economic realities of all pregnant and recently postpartum women in Puerto Rico. Given this, we were struck by the pervasiveness of economic and political worry even in this relatively privileged subsample. How much more so might very poor pregnant women in Puerto Rico experience pre- and peri-natal

stress and what might the impact be on their birth outcomes? We recognize that the experience of the ZIKV threat may have been entirely different for lower-resourced communities living in areas where access to testing and information was less prevalent. Nonetheless, this study describes how maternal concerns related to ZIKV are embedded the historical, political, and social context and that these considerations influence maternal responses to precautionary, public health advice.

Public Health Implications

Mothers' experiences of stress in pregnancy relevant to the ZIKV epidemic cannot be adequately represented from a non-critical perspective or easily operationalized and developed into measures for public health professionals. Maternal narratives suggest that the inherent distrust between the Puerto Rican people and the greater social institutions of the island reduces the success of public health campaigns such as those targeted toward reproduction and ZIKV. Public health organizations, such as the CDC, acknowledged these challenges but did not prioritize the availability of all public health materials in both English and Spanish. Public health messaging should be aware and sensitive of the historical and cultural contexts of areas that have a known history of reproductive exploitation – and encourage protective health behaviors that are sensitive to these social factors and that are significantly more practical (and effective), such as the removal of standing water sites.

Conclusion

Maternal narratives pre- and perinatal stress illustrate that ZIKV exacerbated the effects of daily stressors and that perceptions and health behaviors associated with the virus were influenced by Puerto Rico's colonial reproductive history. Mothers struggled to contend with this institutional distrust while also acknowledging the threat ZIKV was to their fetus – relying on biomedical

measures such as routine ultrasounds to provide them with evidence that they were carrying a healthy pregnancy. Public health messaging across the island was perceived as being insufficient for mothers, and in response, they focused on immediate, tangible life stressors that, from their perspective, served as an equal if not greater threat to the health of their pregnancy. It is possible that ZIKV or similar epidemics will reemerge on the island, and we urge public health and clinical professionals to allocate more resources toward higher-level testing and laboratory analysis, practical lifestyle recommendations, in parallel with the development of public health campaigns that are sensitive to the social, historical, political and economic context of a neo-colonial nation.

Notes

ⁱIn 2016, there were 187 confirmed cases of ZIKV in Cuba and 0 confirmed cases in 2017. This has been attributed to a highly effective public health structure and surveillance system.¹⁷

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Chapter 5: Conclusion and Hurricane Maria Post-Script

Overall, this dissertation aimed to elicit how a neo-colonial context shapes MIH and the ways in which MIH outcomes are socially, politically, historically, and culturally embedded.

The themes presented across this dissertation, highlight the ways that maternal perceptions of stress can be contributed toward a more sophisticated understanding PNMS and its role in the causal pathway of poor MIH outcomes. In this multi-level approach, I aim to describe, with my fellow co-authors, how colonization serves as an underlying and insidious etiology of poor MIH in Puerto Rico. By overlooking this foundational inequity, researchers risk further stigmatizing and pathologizing Puerto Rican people as being a population that is inherently burdened by “poorer health” without acknowledging the structures that are in place that perpetuate such a notion. As evidenced by Maria, which I will discuss in a post-script following this conclusion, these relationships become painfully evident in the aftermath of a natural disaster and in the continental US’s response to the devastation of the lives of US citizens.

This work began in the summer of 2014, when myself, Dr. Melissa Cheyney, and two undergraduate research assistants conducted interviews with 20 Puerto Rican MIH experts with the intent to understand why the preterm birth (PTB) and nulliparous, singleton, term, vertex (NSTV) cesarean sections rates—two of the most significant contributors to Puerto Rico’s elevated perinatal mortality rate (PMR)—remain persistently high in comparison to the US states. Experts identified what we what have described as a syndemic of poor MIH outcomes associated with the island’s status as a US colony, focusing on the intersections between poor nutrition, contaminated water, psychosocial stress, low government-funded health care reimbursement rates, and maternity care mismanagement. Institutional inequities have created an environment in which everyday stressors related to socio-economic inequities cause individuals in Puerto Rico to be less healthy at the start of their pregnancy. Experts also identified that the

Puerto Rican health system bears the brunt of political-economic inequities, resulting in maternity care practices that contribute to elevated rates of preterm and cesarean birth while simultaneously limiting opportunities to improve these outcomes. With a syndemic framework we aimed to elicit how these etiologies collectively intersect to result in poor MIH outcomes in Puerto Rico not as a result of biological determinism but rather persistent political-economic issues that MIH experts and the greater Puerto Rican population are immersed in their everyday lives.

This preliminary work has identified multiple pathways of understanding poor MIH in Puerto Rico, causing us to question how to incorporate the assessment of such a structural inequity into clinical practice. Experts identified potential solutions to the issues that plague the maternity care system, explaining how integrated care models, the legal recognition of additional maternity care providers such as midwives, and increased educational initiatives for both patients and providers could have a significant, positive impact on MIH. Future research is needed to explore the depth of these syndemic connections and how to best assess and address them in clinical practice as well as to explore exactly what areas of integration and education would be most feasible on the island. Additional studies should also include narratives of providers who are opposed to alternative maternity care options, to identify if they have additional insight on how to improve structural inequities that lead to poor MIH outcomes.

Identifying psychosocial stress as one of the many syndemic factors associated with PTB in Puerto Rico, myself, Dr. Cheyney and community partners developed a biocultural, medical anthropological research project exploring the relationship between perceived maternal stress and gestational age at delivery. In phase I of this project, we aimed to contextualized PNMS in Puerto Rico during the childbearing year with 25 pregnant and recently postpartum individuals.

Participant narratives, from a relatively privileged sample of Puerto Rican women, indicated that perceptions of stress were equated with feeling overwhelmed and worried. These feelings were a result of experiences of economic precarity and employment exploitation as women struggled to balance their pregnancy with the demands of work that were not designed to- nor prioritized the needs of reproductive individuals. Outside of their jobs and daily financial struggles, participants were subjected to additional forms of financial inequities, as providers would charge additional costs to privately-insured clients to cover fees associated with running their practice – threatening to terminate care in the event the patient did not pay. With an existing shortage of maternity care providers, this form of violence stems from the inequitable reimbursement rates for non-clinical providers as a result of US federal policy. Interestingly, Puerto Rican mothers have embodied neo-liberal notions of self-help that often resulted in mother-blaming for individuals who had high levels of unmanageable stress. Here, it becomes clear that the embodiment of inequity contributes to the local biologies of pregnant Puerto Rican women as they wade the waters of inequity in a US colony.

To elicit experiences of PNMS in Puerto Rico, I employed the use of local biologies to counter models such as the Puerto Rican Health Disadvantage (PRHD) which draw attention to inequity without directly calling-out the greatest inequity, colonization. Local biologies is a concept from critical biocultural anthropology that focuses on how contexts and lived experiences shape health outcomes, allowing me to call out how Puerto Ricans suffer disproportionately compared to demographically similar populations in the US because of their island's political and economic ties to the US and how it shapes health and healthcare. Interestingly, I describe how Puerto Rican mothers struggle with but yet, embody such colonial perceptions of neoliberalism and motherhood in a negative manner as they critically judge

themselves as well as other mothers who have poor birth outcomes for mismanaging their stress. Limited but critical research on maternal perceptions of stress and pregnancy in Puerto Ricans and other *Latinx/Hispanix* populations demonstrate the importance of anthropological, ethnographic and qualitative data as tools for understanding the complex ways in which human maternal stress becomes a clinical etiology. However, we must contextually nuance experiences of stress to most effectively address some of the most difficult yet pervasive social determinants of health.

During phase I of this project the Zika virus (ZIKV) was declared a public health emergency on the island – shaping a small but critical part of the data collection and analysis process. As we (myself and research assistant Eni Nako) engaged in interviews discussing PNMS, we also inquired about ZIKV – revealing a fascinating relationship between the ZIKV threat, the island’s colonial reproductive history and concerns associated with microcephaly and other ZIKV-related birth defects. Participants revealed that familial concerns related to ZIKV significantly compounded their experiences of stress and decision making related to protecting one’s self during the pregnancy. Mothers also described themselves as being in a conflicted position as they simultaneously suspected that the ZIKV epidemic was actually a means for population control while at the same time expressing a deep concern for protecting their fetus from anomalies associated with vertical transmission. Participants also expressed feelings of frustration and helplessness as ZIKV advertisements, inadequate public health messaging and the media portrayed dire circumstances for expecting individuals who had to continue to live their daily lives knowing that they were at risk. Mothers managed this conflicted position by relying on biomedical measures such as routine ultrasounds to provide them with evidence that they were carrying a healthy pregnancy.

It is possible that ZIKV or similar epidemics will reemerge on the island, and we urge MIH professionals to allocate more resources toward higher-level testing and laboratory analysis and practical lifestyle recommendations, in parallel with the development of public health campaigns that are sensitive to the social, historical, political and economic context of a neo-colonial nation that is afflicted by post-colonial disorders. Future work should consider a more systematic comparison of ZIKV eradication campaigns that were successful such as the one in Cuba – to explore how effective and contextually-sensitive solutions can more sustainably reduce infection rates. In addition, researchers should explore the reasons as to why Puerto Rico did not adopt such initiatives as well as the underlying implications of ZIKV public health materials in English on a Spanish-speaking island. Collectively, this research could not only improve clinical and public health interventions but also expose underlying inequities that result in such epidemics.

We have a better yet, preliminary understanding of PNMS in Puerto Rico but we do not have any conclusive data from the larger PNMS and gestational age at delivery study nor have we discussed the impact of the most devastating event that occurred throughout this research, Hurricane Maria. Psychosocial stress is the most frequently studied disaster-associated health outcome that has been shown to have a greater impact in populations that are socially and clinically vulnerable. Antipova and Curtis (2015) call for more nuanced research on MIH and the impact of natural disasters that includes the “local context in terms of both event and recovery experience” (681) with an emphasis on pre-hurricane life conditions. Our research, which was in a unique position to capture pre and post-Maria stressors, has the potential to demonstrate how inequities in a neo-colonial context, particularly in terms of the lack of immediate disaster-relief efforts, increase stressors associated with MIH outcomes especially in the postpartum period.

This research on PNMS and gestational age at delivery was book-ended by two major public health events that shaped participant's stress experiences in unanticipated and novel ways. Thus, it is difficult to definitively quantify how PNMS was impacted by these experiences. However, Puerto Rico has been subject to centuries of colonization with the most rapid and large-scale changes occurring during the last 120 years of the US regime – resulting in numerous socio-economic and cultural stressors that characterize recent Puerto Rican history. Nuancing PNMS in this context has allowed me and my fellow co-authors to describe how political-economic inequities, as a result of colonization, are pervasive and how maternal stress is not the only factor involved in poor MIH outcomes such as early delivery and unnecessary cesareans. From this perspective, I argue that paying attention to other, more proximate factors associated with PNMS is an important but merely preliminary solution to significant structural problems and that calling out colonial institutions is a critical step forward in health systems reform. However, this is not the only step as a multi-level syndemic requires a multi-level approach where policy makers, health insurance companies, providers, public health professionals and the Puerto Rican families and the mothers themselves need to continue to interrogate the structures that shape their policies, practices and beliefs to reduce the impact of perpetuating colonial forces that continue to truncate the improvement of health in Puerto Rico.

Post-Script: Hurricane Maria

My husband stared at me with hesitation as we packed up our belongings – filling our 2001 Subaru Outback to the brim (again) with essentials including my research data. “I just want to visit one more mom if I can, I don't know what's going to happen after the storm” – I said fighting back tears, lamenting the impact that upcoming Hurricane Maria would have on my ancestral land and all the mothers and babies that I worked with. We had known about Hurricane

Maria, a category four hurricane, since Saturday, September 15th. In the following days, we prepared and watched the news religiously as the storm's trajectory barreled straight for the small island of Puerto Rico – scheduled to arrive on September 20th, 2017. Maria would strike the island just two weeks after Hurricane Irma, making preparations difficult as many of the shelves were still wiped and large portions of the island left without electricity. Irma had simply skirted Puerto Rico and we knew Maria's impact would be much worse.

On the morning of September 19th, 2017, my husband, my 20-month-old daughter, and I headed for the mountain municipality of *Naranjito*, where I had arranged to meet a mother for her final postpartum visit at a local Burger King. When we arrived, the mother was waiting with her toddler and newborn. This mother was memorable – with a significant gap in her front teeth, standing at nearly six feet tall and as a woman of size, she had a gentle and kind disposition and was an incredibly committed research participant who often reached out to me to schedule her visits. During her pregnancy, she struggled with high-blood pressure and suspected intrauterine growth restriction - often traveling nearly two hours one way each week to get additional care from the teaching hospital in *Río Piedras*. When I arrived, she hugged me, and we spent the first 20 minutes of her visit talking about Maria. This mother lived in the mountains in a wooden house – sharing with me “I know I will lose everything”. Despite such a dark sentiment, this mother remained strangely optimistic – sharing with me her plans to take her family down from the mountains to stay in a school that was offering shelter during the storm. The conversation quickly transitioned to her interest in my research and when I was planning to return to the island once my study was complete.

After our visit, I was cleaning my equipment after completing a final hair cortisol sample for both the mother and the infant – again fighting back the tears. I was so emotional not only

from the anticipated devastation but the strength that I witnessed in this mother as well as all the mothers in my study, as they served as the rock of their family even in the face of a natural disaster and total devastation. I also felt conflicted because these tears were not mine to cry, however, I could also relate so deeply with the feeling of having to be the unbreakable foundation for a vulnerable family. I sucked back my tears, and my family and I proceeded to go to *Caguas* to stay with a woman whom we had met prior to Irma – who let us stay at her place since our original home, in the community-center where I did research, was only a couple of blocks from the coast. The Subaru's gas tank was three-quarters full of gas, but the mountain roads can dry a tank fast. We tried to stop and get gas multiple times – only to see everywhere “*no hay gasolina* (there is no gas)”. We still had half a tank and knew we were not more than a 40-minute drive away from *Caguas* – so we proceeded. On the way, we stopped in a mall parking lot in *Bayamón* so I could give money to a cousin to pay a research assistant, a single mother with two kids, an advance for her work – since she was financially desperate and we did not know if I would be able to pay her after the storm. As the day went on, my husband was growing increasingly anxious as early signs of the storm began to show – with heavy winds and rain.

Maybe this is unconditional love or a sign that I am completely unreasonable in the field, by my husband did not tell me that he feared our car would not make it to *Caguas* – because he wanted me to do what I needed to do before the storm. Two-thirds of the way into our trip to *Caguas*, essential car functions ceased starting with electrical power. At this point, there were high winds, rain, and massive lines of traffic waiting to merge on to the highway. I looked at him when the wipers stopped working and I said in a low voice “...what...”. He looked at me and rapidly began telling me about the problems with our car and his repressed anxiety about making

it to Caguas when he learned of my plans to go to the mountains to visit one more participant. He told me if the car stopped, we would not be able to get it started again and that we were still five miles away from our destination. With long traffic lines, we pulled on to the side of the road speeding ahead, as even the boldest of Puerto Rican drivers could not understand what we were doing – honking and yelling at us along the way. We got less than two miles away and the car began to sputter every time we put on the breaks – we both started screaming, praying for no other stoplights on the way. We began to drive all over the road – speeding to get to the “Mango House” in Caguas – a beautiful old property covered in mango trees planted more than 50 years ago. When we arrived, the car immediately shut down. For a moment, we both sat in silence as the wind and rain batted our windows. After this moment, we collected ourselves and decided to unload the car – not speaking of this situation again until after the storm had passed.

That night we prepared the small bathroom as a storm shelter but went to sleep in the one-bedroom of the basement apartment where we were staying. The breeze from the storm winds, still relatively gentle at this point, felt good and relieved me of the anxiety I was feeling about the storm and its aftermath. A couple of hours later around two a.m., my entire family awoke due to strong winds that felt as if they could blow the storm shutters off the windows. I picked up my daughter and headed to the bathroom, where we had prepared a little bed in the shower. My husband and I sat on tall buckets of water, drank wine and looked outside a tiny window of the bathroom to watch the storm as turned strong, large mango trees into weeds blowing in the wind. Water spewed into the house for hours through the windows and under the door – we watched signs, household equipment, and debris fly by. The upper deck of the house was connected to the mango trees on the property we were staying at – so we spent 12 or more hours listening to a deck being pulled off the house. When the eye of the hurricane began to pass

over, I could feel the pressure in my ears drop each time a strong wind would hit – making me feel strangely connected to the intensity of the storm. By two in the afternoon, the worst of the damage had been done and we emerged from the bathroom an hour later. I spent the rest of the day emotionally on edge as we cleaned our property and watched locals flock to the local bar across the street as they ran a small generator to sell all their perishables and beer before the reality of the hurricane hit.

In the days following Maria, we spent time trying to figure out how to contact family, how to fix our car, and how to find out the state of the property where we lived near the coast. The morning immediately after the storm, we ventured out to assess the damage – seeing all the large palm trees uprooted, light poles and buildings completely mangled, and all the beautiful trees on the mountains wiped down to little sticks. People were waiting in lines outside of grocery and hardware stores where they only allowed a certain number of people in at a time to purchase the remainder of their supplies. We also saw in the early aftermath of the storm, people coming together to clear the streets, removing light poles and large trees. During this time, we helped clean up the Mango House – where my husband used a hand saw to cut down trees and I cleaned up flood waters with a toddler strapped to my back. We also walked to various locations such as Walgreens and McDonalds which were rumored to have access to WIFI and a usable telephone – none of which were actually true. Three days after the storm, we knew we needed to fix our car, get gas, and to get back to the coast – after being able to get a faint signal on my phone for a moment to send a mass text that we were alive and well. Another friend we made in the aftermath of the storm, gave us her car to use and a small gas can to fill up for our car. We got up at 3 a.m. four days after the storm and waited six hours in line to get gas – not moving one inch as police cars and other services vehicles took priority. That day we decided to see if an

auto parts store was open – which shockingly was. We bought the part we needed for our car, dropped the other vehicle to our friend with a stack of apologetic cash – and dashed with the little gas we had left to the tank to the coast – checking our phones along the way to see if we could get a signal.

We got back the property near the coast and aside from trees being blown over, everything was okay. Over the next 3 days, we prepared for our evacuation by my university. Through spotty cell service, additional car repairs, packing up all our belongings, and surviving hot, humid still nights with little to no sleep – we were picked up to go to the airport on the morning of September 27th, 2019. The airport experience was also difficult as a massive line of people waited outside Spirit airlines, but we were flying Delta – with no line and we had a man we paid to help us carry our bags. The power went out once during check-in and then we proceeded to be funnel to the only functioning-gate, waiting in the heat for nearly two hours during security check-in before we got bumped in the line due to the time of our flight. Sweaty, exhausted, and emotional we sat at the gate and waited to get on our plane drinking a cold beverage from the only shop open in the airport. When the plane arrived, camera crews and electricians emerged from the plane, and as I looked around, I saw numerous elderly and infants boarding our flight. When the flight attendant announced the plane was ready to board people rushed the door. The flight attendant used a megaphone, yelling for people to get back and threatening to cancel the flight. I looked at my husband, it was so surreal. We finally boarded after a few unintentional elbows to the face and sat on the tarmac for one hour in the air-conditioned plane finally processing the whole experience.

I cried the whole flight to New York; it was so visceral I could not control it. Due to delays in Puerto Rico, we had to stay overnight in New York City in a questionable quality hotel

that did not have room keys or locks on the door (we used a chair). After putting my daughter to sleep following an epic emotional melt down while we waited for the bus, I took a shower and ate vending machine food with my husband in the bathroom. I cried and laughed the whole night as the experience at the hotel seem like an unbelievable luxury compared to our experiences in the aftermath of Maria. The next day, I was finally able to speak on the phone with my family who was overwhelmed with relief that we were okay – eventually growing physically and emotionally weary of telling the story of Maria – an experience that I was just beginning to process.

On February 1st, 2019 my daughter and I returned to the island to complete data collection. Puerto Rico's mountains were covered in green once again but the homes, the communities, the towns looked almost the same as the day we left just one-week after the storm. Flying away at the end of that month, I reflected on the conception of a colony – and how in the aftermath of Maria we saw not one government official on the island and that the people themselves took the initiative to clean up their communities. As the plane took off from San Juan International Airport, I held my daughter tight as I watched how the wounds of colonization were symbolized through the stuccoing of blue tarps that served as roofs for homes, many of which are still there to this day. Maria was more than just a natural disaster it was a gross exposure of structural inequities perpetuated by the US Federal government (thanks for the paper towels) that Puerto Rican people have not only become accustomed to but have also embodied. This experience has led me to contemplate the challenges before myself, community partners, and fellow scholars as we not only further expose these inequities but attempt to address them in sustainable and effective ways in our efforts to improve MIH in a place that experienced a significant transformation from when I first started my fieldwork in August 2016.

References

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APPENDICIES

APPENDIX A IRB Approved Consent Document for the pilot study

STUDY ID
6220

Notification Type	APPROVED		
Date of Notification	5/28/2014		
Study Title	A Health State?: An Exploratory pilot study of Maternal and Infant Health Concerns in Puerto Rico		
Principal Investigator	Melissa Cheyney		
Study Team Members	Holly Horan, Marlene Cervantes, Audrey Aprilla		
Submission Type	Initial Application		
Level	Expedited	Category(ies)	6, 7
Number of Participants	20 <i>Do not exceed this number without prior IRB approval</i>		
Waiver(s)	None		
Risk Level for Children	N/A		
Funding Source	None	Proposal #	N/A
PI on Grant or Contract	N/A		

The above referenced study was reviewed and approved by the OSU Institutional Review Board (IRB).

Approval Date: 05/28/2014

Annual continuing review applications are due at least 30 days prior to expiration date

Expiration Date: 05/27/2015

Documents included in this review:

- | | | |
|---|--|--|
| <input checked="" type="checkbox"/> Protocol | <input checked="" type="checkbox"/> Recruiting tools | <input type="checkbox"/> External IRB approvals |
| <input checked="" type="checkbox"/> Consent forms | <input checked="" type="checkbox"/> Test instruments | <input type="checkbox"/> Translated documents |
| <input type="checkbox"/> Assent forms | <input type="checkbox"/> Attachment A: Radiation | <input type="checkbox"/> Attachment B: Human materials |
| <input type="checkbox"/> Alternative consent | <input type="checkbox"/> Alternative assent | <input type="checkbox"/> Grant/contract |
| <input type="checkbox"/> Letters of support | <input type="checkbox"/> Project revision(s) | <input type="checkbox"/> Other: |

Comments:

Principal Investigator responsibilities for fulfilling the requirements of approval:

- All study team members should be kept informed of the status of the research.
- Any changes to the research must be submitted to the IRB for review and approval prior to the activation of the changes. **This includes, but is not limited to, increasing the number of subjects to be enrolled.**
- Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.
- Only consent forms with a valid approval stamp may be presented to participants.
- Submit a continuing review application or final report to the IRB for review at least four weeks prior to the expiration date. Failure to submit a continuing review application prior to the expiration date will result in termination of the research, discontinuation of enrolled participants, and the submission of a new application to the IRB.

APPENDIX B IRB Approved Consent Document for the dissertation project

**APPROVAL
 NOTICE**

Date of Notification	04/06/2016		
Study ID	7296		
Study Title	Territorial Biologies and the Premature Body: Maternal Stress and Gestational Age at Delivery in Cayey, Puerto Rico		
Principal Investigator	Melissa Cheyney		
Study Team Members	Holly Horan		
Submission Type	Initial Application	Date Approved	04/05/2016
Level	Expedited	Category(ies)	3,6, 7
Number of Participants	425 <i>Do not exceed this number without prior IRB approval</i>		
Waiver(s)	Documentation of Informed Consent		
Risk Level for Children	§46.404 minimal risk		
Funding Source	Oregon Sasakawa Young Leaders Fellowship Fund (Sylff - Awarded); 2015 Kathryn Ross Scholarship Award (Awarded); National Science Foundation, Cultural Anthropology Program – Doctoral Dissertation Research Grant (Pending)	PI on Grant or Contract	Holly Horan, Melissa Cheyney (NSF)
Proposal #	N/A	Cayuse #	N/A

The above referenced study was reviewed and approved by the OSU Institutional Review Board (IRB).

EXPIRATION DATE: 04/04/2017

Annual continuing review applications are due at least 30 days prior to expiration date

Documents included in this review:

- | | | |
|---|--|--|
| <input checked="" type="checkbox"/> Protocol | <input checked="" type="checkbox"/> Recruiting tools | <input checked="" type="checkbox"/> Translated documents |
| <input type="checkbox"/> Consent forms | <input checked="" type="checkbox"/> Test instruments | <input type="checkbox"/> Attachment B: Human materials |
| <input type="checkbox"/> Assent forms | <input type="checkbox"/> Attachment A: Radiation | <input checked="" type="checkbox"/> Grant/contract |
| <input checked="" type="checkbox"/> Alternative consent | <input type="checkbox"/> Alternative assent | <input type="checkbox"/> Other: |
| <input checked="" type="checkbox"/> Letters of support | <input type="checkbox"/> External IRB approvals | |

Comments: Waiver of documentation of consent for all participants.

Principal Investigator responsibilities for fulfilling the requirements of approval:

- All study team members should be kept informed of the status of the research.
- Any changes to the research must be submitted to the IRB for review and approval prior to the activation of the changes. **This includes, but is not limited to, increasing the number of subjects to be enrolled.** Failure to adhere to the approved protocol can result in study suspension or termination and data stemming from protocol deviations cannot be represented as having IRB Approval.
- Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.
- Only consent forms with a valid approval stamp may be presented to participants.

APPENDIX C IRB Approved for infant hair samples



Human Research Protection Program
 Institutional Review Board
 Office of Research Integrity
 8308 Kerr Administration Building, Corvallis, Oregon 97331-2140
 (541) 737-8008
IRB@oregonstate.edu | <http://research.oregonstate.edu/irb>

**APPROVAL
 NOTICE**

Date of Notification	10/13/2016	Date Approved	10/13/2016
Principal Investigator	Melissa Cheyney	Study ID	7296
Study Title	Territorial Biologies and the Premature Body: Maternal Stress and Gestational Age at Delivery in Cayey, Puerto Rico		
Study Team Members	Holly Horan, Eni Nako		
Review Level	Expedited	Category(ies)	3,6, 7
Submission Type	Project Revision		
Waiver(s)	Documentation of Informed Consent		
Risk Level for Children	§46.404 minimal risk		
Number of Participants	425 Do not exceed this number without prior approval		
Funding Source	Oregon Sasakawa Young Leaders Fellowship Fund (Sylff - Awarded); 2015 Kathryn Ross Scholarship Award (Awarded); National Science Foundation, Cultural Anthropology Program – Doctoral Dissertation Research Grant (Awarded)	PI on Funding	Holly Horan, Melissa Cheyney (NSF)
Proposal #	1628643 (NSF)	Cayuse #	16-1189

The above referenced study was reviewed and approved by the OSU Institutional Review Board (IRB).

EXPIRATION DATE: 04/04/2017

Continuing review applications are due at least 30 days prior to expiration date

Comments: Waiver of documentation; Revised survey instruments

Please note when applicable, if the PI has not already done so, the HRPP staff will update the version date on the protocol and consent document(s).

Principal Investigator responsibilities for fulfilling the requirements of approval:

- All study team members should be kept informed of the status of the research.
- Any changes to the research must be submitted to the IRB for review and approval prior to the activation of the changes. **This includes, but is not limited to, increasing the number of subjects to be enrolled.** Failure to adhere to the approved protocol can result in study suspension or termination and data stemming from protocol deviations cannot be represented as having IRB Approval.
- Reports of unanticipated problems involving risks to participants or others must be submitted to the HRPP office within three calendar days.
- Only consent forms with a valid approval stamp may be presented to participants.
- Submit a continuing review application or final report to the HRPP office for review at least four weeks prior to the expiration date. Failure to submit a continuing review application prior to the expiration date will result in termination of the research, discontinuation of enrolled participants, and the submission of a new application to the IRB.

APPENDIX D Sample Eligibility Screen (English)

Participant Code:
Visit #:
Date:

SCREENING AND DEMOGRAPHIC SURVEY

PREGNANCY QUESTIONS:

1. Are you pregnant? Yes No

2. How many weeks pregnant are you? _____

3. When did you begin prenatal care? First trimester Second Trimester Third Trimester

4. Where do you receive prenatal care? MAM Menonitas Hospital de Cayey
 Other: _____

5. Where do you plan to deliver? Home Menonitas Hospital de Cayey Other: _____

6. Previous pregnancies? Yes, If yes, how many? _____ No

7. Previous preterm births (birth before 37 weeks of pregnancy)? Yes, If yes, how many weeks? _____ N/A

8. Did you want to be pregnant right now?: Yes No

9. Pre-pregnancy weight and height: Weight (lbs) _____ Height (ft) _____

10. Do you smoke? Yes; If yes, how many cigarettes per day? _____ No

11. How often do you experience stress (for example, feeling bothered, worried, upset, out of control, overwhelmed)? Never Monthly Weekly Daily

DEMOGRAPHIC QUESTIONS:

12. Sex: Male Female No answer

13. Age: _____

14. Marital Status: Single Partnered (not married) Married Widowed Divorced; If divorced, have you remarried? Yes No

15. **Race:** White black/African American Native Hawaiian or Pacific Islander Asian Mixed Other, please specify: _____
16. **Ethnicity:** Latino/Hispanic; If Latino/Hispanic, please specify: _____ Other; If other, please specify: _____
17. **Color:** Blanco Trigueño Negro None Other; If other please specify: _____
18. **Do you currently live in Puerto Rico?** Yes No
19. **Are you an immigrant?** Yes No
20. **How long have you lived in Puerto Rico?** Born in PR 0 – 5 years 5 – 10 years 10 – 15 years 15+ years
21. **What is your highest, completed level of education?:** Less than high school High School Some College (no degree) Technical Degree Associates Degree Bachelors Masters Doctorate
22. **Health Insurance:** Private *La Reforma* (Medicaid) None Other, please specify: _____
23. **What income category best describes you?:** Low-income Middle-income High-income
24. **Occupation:** _____
25. **Number of working hours per week where you make an income:** _____

APPENDIX E Sample Eligibility Screen (Spanish)

Código Participante:

Visita #:

Fecha:

EMBARAZO Y ENCUESTA DEMOGRÁFICA

Preguntas Embarazo:

1. ¿Está embarazada? Sí No

2. ¿Cuántas semanas de embarazo es usted? _____

3. ¿Cuándo empezaste cuidado prenatal?: Primer trimestre Segundo Trimestre Tercer trimestre

4. ¿Dónde reciben servicios prenatales? MAM Menonitas Hospital de Cayey
 Otros: _____

5. ¿Dónde vas a dar a luz? Mi casa Menonitas Hospital de Cayey Otros: _____

6. ¿Tiene embarazos anteriores? Sí; En caso afirmativo, ¿cuántos? _____ No

7. ¿Tiene nacimientos prematuros anteriores (nacimiento antes de las 37 semanas de embarazo)?
Sí; En caso afirmativo, ¿cuántos semanas? _____ No N/A

8. ¿Querías estar embarazada ahora? Sí No

9. Peso y altura antes de este embarazo: Peso (lbs) _____ Altura (ft) _____

10. ¿Fuma usted? Yes; Sí; En caso afirmativo, ¿cuántos cigarrillos cada semana? _____ No

11. ¿Con qué frecuencia se siente estresado (por ejemplo, sentirse molesto, preocupado, molesto, fuera de control, abrumado)? Nunca Mensual Cada semana
 Diariamente

PREGUNTAS DEMOGRÁFICOS:

12. Sexo: Masculino Mujer No hay respuesta

13. Años: _____

- 14. ¿Cuál es su estado civil?** Soltero Compañero (no casado) Casado Viudo
 Divorciado; Si usted está divorciado, ¿estás casado de nuevo? Sí No
- 15. Raza:** Blanco negro/ Afroamericano Nativo de Hawai o Islas del Pacífico Asiático
 Mestizos Otros, por favor especifica: _____
- 16. Etnicidad:** Latino/ Hispano; Si Latino / Hispano, por favor especifique _____
 Otros, por favor especifica: _____
- 17. Color:** Blanco Trigueño Negro Ninguno Otros, por favor especifica: _____
- 18. ¿Vive en Puerto Rico?** Sí No
- 19. ¿Es usted un inmigrante?** Sí No
- 20. ¿Cuántos años ha vivido en Puerto Rico?** Nacido en PR 0 – 5 años 5 – 10 años 10 – 15 años 15+ años
- 21. ¿Cual es tu mayor nivel de educación?** Algún escuela secundaria Escuela secundaria Un poco de universidad (sin título) Título técnica Diploma de asociado Bachillerato Maestría Doctorado
- 22. Seguro de salud:** Privado *La Reforma* (Medicaid) Ninguno
 Otros, por favor especifica: _____
- 23. ¿Qué categoría de ingresos te describe mejor?** De bajos ingresos Ingreso Medio Altos Ingresos
- 24. Profesión:** _____
- 25. ¿Cuántas horas trabaja cada semana cuando usted hace una renta?** _____

Appendix F Sample Pilot Study Interview Guide

Interview Guide

To be used as a guideline for interviewing the participants.

Interview Introduction

- Interview will be coordinated with the participant in-person, by telephone or email.
- Participants will have been consented prior to interview time but will be reminded that they may be identifiable based on the small sample and region of the study.
- Discuss the purpose of audio recording and explain any associated technical issues that may occur during the interview.
- Explain that:
 - The participant can stop at any time (reiterate from consent form) and terminate their involvement in the study or reschedule if they are interested in continuing in the project.
 - Participants are also welcome to request the cessation of audio recording or to have information erased from record if they change their mind about disclosing specific information. This request can occur during the interview or after the interview has ended. The participant can contact the student researchers to remove this information from the record.
 - The student researchers will explain that they are interested in learning more about maternal and child health issues and health system barriers in Puerto Rico. Student researchers may ask participants to clarify or expand on some aspect of their narrative within the course of the interview and intend on being active listeners.

Intake Questions:

Script: Thank you for taking the time to answer some questions about the maternal and child health in Puerto Rico. If you feel uncomfortable or do not want to answer any of the interview questions at any point during the interview, please let me know and we can move on to the next question.

To begin we'd like to ask some initial intake questions:

Educational background:

Occupation:

Number of years in this position?

Additional qualifications as a MCH professional?

What/if any previous positions have you held in MCH in Puerto Rico or elsewhere and for how long?

Demographic intake questions:

Age:

Ethnicity:

Location:

Maternal and Health Concerns in Puerto Rico Questions :

From your perspective, please describe the status of maternal and child health in your practice/region.

- Post Question Probe:
 - How is this related to your career path as an MCH professional?
 - To the best of your knowledge, what is the status of MCH island-wide?
 - How has this shifted since the beginning of your practice/career (both locally and regionally)?

What do you think are the greatest maternal and child health concerns in your practice/region?

- Post Question Probe:
 - Do you think these concerns shifted over the course of your practice?
 - Do you think your concerns are similar or different from other MCH providers throughout the island? Why?

In your opinion, what are the causes of these health issues?

- Post Question Probe:
 - Do you think these health issues are related to shifts in health care practice?
 - What do you think are some of the social causes of poor health in these populations?
 - How do you think these social causes affecting maternal and child health outcomes?

What do you think are the implications for poor maternal and child health outcomes?

- Post Question Probe:
 - How do you think this related to health over the life-course?
 - In what ways does this affect Puerto Rican society both locally and at-large?

Health Systems Infrastructure Questions:

Who do you think are the key players in sustaining and improving maternal and child health programs in Puerto Rico?

In your opinion, what have been the primary strengths and weaknesses of these maternal and child health programs and services?

- Post Question Probes
 - How do you think these weaknesses been addressed? What efforts were successful and what was not?
 - What do you think are the barriers to addressing these issues?
 - How do you think these strengths and weaknesses have shifted since the beginning of your practice/career?

What do you think are the goals of existing MCH programs?

- Post Question Probes
 - Have you witnessed these goals shift over time?
 - How do you think the goals have shifted in response to MCH professional concerns?

- How do you think these goals shifted in response the concerns of the MCH community?

How do you see MCH programs in Puerto Rico changing over the next 40 years?

- Post Question Probes
 - What shifts will be essential to the improvement of MCH practice and care?
 - What shifts will be detrimental to the improvement of MCH practice and care?
 - What resources will be necessary to support or suppress these changes?

In terms of interventions, what MCH interventions do you believe have been most effective in Puerto Rico?

- Post Question Probes
 - How was this intervention developed?
 - What improvements or changes could be made to improve the efficacy of this intervention?

Script: As stated in the informed consent, the purpose for this interview is to assess the conditions of MCH in Puerto Rico to develop a future dissertation research project in Applied Medical Anthropology. The scope of this dissertation research focuses on the relationship between low birth weight, preterm birth and its relationship to maternal stress. Now we will move into just a few questions addressing these topics from your experience.

Maternal Stress and Live-Birth Outcomes in Puerto Rico:

What do you know about the relationship between maternal stress and poor birth outcomes in Puerto Rico?

- Post Question Probes
 - How does maternal stress and poor birth outcomes apply to your practice?
 - What are you interested in learning about maternal stress and birth outcomes?

Based on your experience as a MCH professional, what causes maternal stress?

- Post Question Probes
 - How is maternal stress related to other health outcomes both for the mother and her family?
 - How does experience of maternal stress vary throughout your community?
 - How does the experience of maternal stress vary throughout Puerto Rico?

What do you believe are the consequences of poor birth outcomes? Both immediate and long-term?

- Post Question Probes
 - How are these outcomes related to maternal stress?
 - What are MCH professionals doing to address this issue?
 - What other organizations are involved in this effort?

What do you believe are the most effective ways to address/intervene on maternal stress?

- Post Question Probes
 - What has been done in Puerto Rico to address this issue?
 - What are the barriers to improving maternal stress?

Exiting Questions:

Is there any other information or topics that you would like to discuss in regards to MCH in Puerto Rico?

If you were to conduct a study integrating self-reports of maternal stress with biomarker data of stress, how would you do this? What resources would you need?

Thank you for taking the time to participate in this interview.

In an effort to further include our participants' voices in our research, we will be sending you a draft of our preliminary findings. Please feel free to send us back any comments, edits or suggestions that you believe will refine our research and we will include these in our development of the dissertation research project. Again, thank you for assisting us as we construct a locally valid project studying the relationship between maternal stress and poor live-birth outcomes in Puerto Rico.

APPENDIX G Phase I Sample Interview Guide (English)

Interview Guide

To be used as a guideline for interviewing the participants.

Interview Introduction

- Interview will be coordinated with the participant in-person, by telephone or email.
- Participants will have been consented prior to interview time but will be reminded that they may be identifiable based on the small sample and region of the study. The demographic survey will also be completed prior to the interview.
- Discuss the purpose of audio recording and explain any associated technical issues that may occur during the interview.
- Explain that:
 - The participant can stop at any time (reiterate from consent form) and terminate their involvement in the study or reschedule if they are interested in continuing in the project.
 - Participants are also welcome to request the cessation of audio recording or to have information erased from record if they change their mind about disclosing specific information. This request can occur during the interview or after the interview has ended. The participant can contact the student researchers to remove this information from the record.
 - The student researcher will explain that they are interested in learning more about stress and how it affects pregnancy and birth outcomes in Puerto Rico. The student researcher may ask participants to clarify or expand on some aspect of their narrative within the course of the interview and intend on being active listeners.

Intake Questions:

Script: Thank you for describing your experiences and perceptions of stress during pregnancy while living in Puerto Rico. If you feel uncomfortable or do not want to answer any of the interview questions at any time during the interview, please tell me and we can go to the next question.

Exploring the concept of stress in Puerto Rico:

What does the word “stress” mean to you?

- Post Question Probe:
 - What are some ways that stress has affected you in your life?
 - Is there another term or concept that you would use to describe these experiences, besides the word “stress”?
 - If so, where did you learn about these various concepts of stress?

How do you think stress in Puerto Rico is different from other places in the world such as the United States or Latin America?

- Post Question Probe:
 - How do you think stress is similar in other places in the world?
 - Why is stress in Puerto Rico similar or different to these other areas?

How do you reduce or eliminate stress?

- Post Question Probe:
 - How do you include these practices in your daily life?
 - Who or what helps you reduce or eliminate stress?
 - What causes your stress to become worse?

How do you believe stress affects your health?

- Post Question Probe:
 - What are some negative ways stress affects your health?
 - What are some positive ways stress affects your health?
 - What kind of care do you receive when stress affects your health?

Pregnancy and Stress-Specific Questions:

How does stress affect your pregnancy?

- Post Question Probes:
 - What causes this stress?
 - How has your experience of stress changed since becoming pregnant with this baby?
 - How has your experience of stress changed since becoming pregnant for the first time?

How do you think stress affects your health and the health of your baby?

- Post Question Probes:
 - Who or what else is affected by stress during pregnancy?
 - What do you do to reduce stress during pregnancy?
 - How does stress in pregnancy affect birth outcomes?

What other information is important to discuss, in regard to stress and pregnancy?

Thank you for taking the time to participate in this interview. If you have any questions or would like something you said to be removed from the record, please contact Holly Horan at (319) 429 – 3758 or horanh@onid.orst.edu.

Appendix H Phase I Sample Interview Guide (Spanish)

Guía de Entrevista

Para ser utilizado como una guía para entrevistar a los participantes.

Entrevista Introducción

- Entrevista será coordinado con el participante en persona, por teléfono o correo electrónico.
- Los participantes han dado su consentimiento antes de la entrevista y se les recordó que puedan ser identificados con base en la pequeña muestra y la región del estudio. La encuesta demográfica también se completará antes de la entrevista.
- El estudiante investigador discutirá el propósito de la grabación la entrevista y explicar los problemas técnicos asociados que pueden ocurrir durante la entrevista.
- Ella va a explicar que:
 - El participante puede parar en cualquier momento (repetición del formulario de consentimiento) y poner fin a su participación en el estudio o reprogramar si quieren continuar con el proyecto.
 - Los participantes pueden solicitar para detener la grabación de la entrevista o tener información eliminado de la entrevista si cambian de opinión acerca de compartir información específica. Esta petición puede ocurrir durante la entrevista o después de la entrevista ha terminado. El participante puede ponerse en contacto con el investigador del estudiante para eliminar esta información de la entrevista.
 - El estudiante investigador explicará que quieren aprender más sobre el estrés y cómo afecta el embarazo y el nacimiento en Puerto Rico. El investigador estudiante puede pedir al participante que decirles más sobre alguna parte de su entrevista y la intención de ser un oyente activo.

Preguntas de Entrevista:

Gracias por la descripción de sus experiencias y percepciones de estrés durante el embarazo en Puerto Rico. Si se siente incómodo o no quiere contestar ninguna de las preguntas de la entrevista en cualquier momento durante la entrevista, por favor dígame y podemos ir a la siguiente pregunta.

Explorando el concepto de estrés en Puerto Rico:

¿Cómo se entiende la palabra "estrés"?

- Sonda Pregunta:
 - ¿Cómo ha sido afectado por el estrés en su vida?
 - ¿Qué otras palabras o conceptos describir el "estrés"?
 - ¿Dónde aprendiste acerca de estos conceptos de estrés?

¿Cómo es el estrés en Puerto Rico diferente de otros lugares en el mundo, como Estados Unidos o América Latina?

- Sonda Pregunta:
 - ¿Cómo es el estrés en Puerto Rico similar a otros lugares del mundo?
 - ¿Por qué es el estrés en Puerto Rico similar o diferente a estas otras áreas?

¿Cómo se puede reducir o eliminar el estrés?

- Sonda Pregunta:
 - ¿Cómo incluir estas prácticas en su vida diaria?
 - ¿Qué le ayuda a reducir o eliminar el estrés?
 - ¿Qué causa el estrés empeore?

¿Cómo afecta el estrés a su salud?

- Sonda Pregunta:
 - ¿Cómo es el estrés malo para la salud?
 - ¿Cómo es el estrés bueno para la salud?
 - ¿Qué tipo de cuidados recibe usted cuando el estrés afecta a su salud?

Embarazo y estrés específico Preguntas:

¿Cómo afecta el estrés a su embarazo?

- Sonda Pregunta:
 - ¿Qué causa este estrés?
 - ¿Cómo ha sido su experiencia de estrés cambiado desde que se convirtió embarazada de este bebé?
 - ¿Cómo ha sido su experiencia de estrés cambiado desde quedar embarazada por primera vez?

¿Cómo cree que el estrés afecta a su salud y la salud de su bebé?

- Sonda Pregunta:
 - ¿Quién o qué más se ve afectado por el estrés durante el embarazo?
 - ¿Qué hacer para reducir el estrés durante el embarazo?
 - ¿Cómo el estrés durante el embarazo afecta a los resultados del parto?

¿Qué otra información es importante discutir , en lo que respecta a la tensión y el embarazo?

Gracias por participar en esta entrevista. Si tiene cualquier pregunta o quiere quitar nada de la entrevista, por favor póngase en contacto con Holly Horan a (319) 429 – 3758 o horanh@onid.orst.edu.

Appendix I Cohen Perceived Stress Scale with added question (English)

Participant Code:
Visit #
Date:

Cohen Perceived Stress Scale- 11 Item *

**Includes one additional context-specific question for Puerto Rico based on information collected in phase 1 of this study.*

Instructions: *The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please circle how often you felt or thought a certain way.*

1. In the last month, how often have you been upset because of something that happened unexpectedly?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
2. In the last month, how often have you felt that you were unable to control the important things in your life?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
3. In the last month, how often have you felt nervous and "stressed"?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
5. In the last month, how often have you felt that things were going your way?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
7. In the last month, how often have you been able to control irritations in your life?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
8. In the last month, how often have you worried that there would not be enough money to cover the costs of your family's basic needs?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
9. In the last month, how often have you felt that you were on top of things?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often
10. In the last month, how often have you been angered because of things that were outside of your control?
0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often

11. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often

Appendix J Cohen Perceived Stress Scale with added question (Spanish)

Código Participante:

Visita #:

Fecha:

Cohen Escala De Estrés Percibido - 11 reactivos*

**Incluye una pregunta específicamente sobre Puerto Rico basado a la información recopilada en la fase 1 de este estudio.*

Instrucciones: *Las preguntas en esta escala son sobre tus sentimientos, pensamientos y actividades durante el último mes, incluyendo el día de hoy. En el último mes, incluyendo el día de hoy, con cuánta frecuencia:*

1. ¿En el último mes, ¿te has sentido alterado porque han ocurrido eventos inesperados?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
2. ¿En el último mes, ¿te has sentido incapaz de controlar aspectos importantes de tu vida?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
3. ¿En el último mes, ¿te has sentido nervioso y “estresado”?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
4. ¿En el último mes, ¿te has sentido confiado en tu habilidad para manejar tus problemas personales?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
5. ¿En el último mes, ¿has sentido que las cosas suceden como tú quieres a que sean?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
6. ¿En el último mes, ¿has sentido que no puedes manejar las cosas que tienes que hacer?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
7. ¿En el último mes, ¿te has sentido que puedes controlar los malestares de la vida?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
8. En el último mes, ¿cuántas veces ha preocupado de que no habría dinero suficiente para cubrir los costos de las necesidades básicas de su familia?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
9. ¿En el último mes, ¿te has sentido que estás en control de tu vida?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
10. ¿En el último mes, ¿te has sentido con coraje porque las cosas están fuera de control?
0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre
11. ¿En el último mes, ¿has experimentado dificultades que no puedes sobrellevar?

0 = Nunca 1 = Casi nunca 2 = A veces 3 = Casi siempre 4 = Siempre

Appendix K Revised Prenatal Distress Questionnaire with added questions (English)

Participant Code:

Visit #

Date:

Revised Prenatal Distress Questionnaire*

**Includes three additional context-specific questions for Puerto Rico based on information collected in phase 1 of this study.*

Instructions: *The questions in this scale ask you about your feelings right now, at this moment in your pregnancy. In each question, please indicate how often you feel or think a certain way.*

Repeated at each time point:

Are you feeling bothered, upset, or worried at this point in your pregnancy about:

1. ...the effect of ongoing health problems such as high blood pressure or diabetes in your pregnancy?

0 = Not at all

1 = Somewhat

2 = Very much

2. ...feeling tired and having low energy during your pregnancy?

0 = Not at all

1 = Somewhat

2 = Very much

3. ...paying for your medical care during pregnancy?

0 = Not at all

1 = Somewhat

2 = Very much

4. ...changes in your weight and body shape during pregnancy?

0 = Not at all

1 = Somewhat

2 = Very much

5. ...whether your baby is developing normally?

0 = Not at all

1 = Somewhat

2 = Very much

6. being able to protect the health of your baby?

0 = Not at all

1 = Somewhat

2 = Very much

7. ...whether you might have an unhealthy baby?

0 = Not at all

1 = Somewhat

2 = Very much

8. physical symptoms of pregnancy such as vomiting, swollen feet, or backaches?

0 = Not at all

1 = Somewhat

2 = Very much

9. ...the quality of your medical care during pregnancy?

0 = Not at all

1 = Somewhat

2 = Very much

10. ...working or caring for your family during your pregnancy?

0 = Not at all

1 = Somewhat

2 = Very much

11. ...whether Zika will have immediate and/or long term effects on your baby's health and well-being?

0 = Not at all

1 = Somewhat

2 = Very much

12. ...whether the baby might be affected by alcohol, cigarettes, or drugs that you have taken?

0 = Not at all

1 = Somewhat

2 = Very much

Repeat at second and third timepoint:

Are you feeling bothered, upset, or worried at this point in your pregnancy about:

13. ...whether the baby might come too early?

0 = Not at all

1 = Somewhat

2 = Very much

14. ...changes in your relationship with other people due to having a baby?

0 = Not at all

1 = Somewhat

2 = Very much

15. ...paying for the baby's clothes, food, or medical care?

0 = Not at all

1 = Somewhat

2 = Very much

Added at third timepoint:

Are you feeling bothered, upset, or worried at this point in your pregnancy about:

16. ...taking care of a newborn baby?

0 = Not at all

1 = Somewhat

2 = Very much

17. ...pain during labor and delivery?

0 = Not at all

1 = Somewhat

2 = Very much

18. ...what will happen during labor and delivery?

0 = Not at all

1 = Somewhat

2 = Very much

19. ...working at a job after the baby comes?

0 = Not at all

1 = Somewhat

2 = Very much

20. ...who will help me after the baby arrives?

0 = Not at all

1 = Somewhat

2 = Very much

Appendix L Revised Prenatal Distress Questionnaire with added questions (Spanish)

Código Participante:

Visita #:

Fecha:

Cuestionario Revisado de Angustia Prenatal *

**Incluye tres preguntas específicamente sobre Puerto Rico basado a la información recopilada en la fase 1 de este estudio.*

Instrucciones: *Las preguntas de esta escala que preguntan acerca de sus sentimientos en este momento, en este momento de su embarazo. En cada pregunta, por favor indicar la frecuencia con que se siente o piensa de una determinada manera.*

Repetida en cada momento:

Se siente enojado, molesto o preocupado en este momento de su embarazo sobre:

1. ... ¿el efecto de los problemas de salud en curso, como la hipertensión arterial o la diabetes en el embarazo?

0 = Ahora no 1 = Algunos 2 = Mucho

2. ... ¿sensación de cansancio y con bajo de energía durante su embarazo?

0 = Ahora no 1 = Algunos 2 = Mucho

3. ... ¿pagar por su atención médica durante el embarazo?

0 = Ahora no 1 = Algunos 2 = Mucho

4. ... ¿cambios en su peso y apariencia del cuerpo durante el embarazo?

0 = Ahora no 1 = Algunos 2 = Mucho

5. ... ¿si el bebé se está desarrollando normalmente?

0 = Ahora no 1 = Algunos 2 = Mucho

6. ¿ser capaz de proteger la salud de su bebé?

0 = Ahora no 1 = Algunos 2 = Mucho

7. ... ¿si es que tenga un bebé de poco saludable?

0 = Ahora no 1 = Algunos 2 = Mucho

8 ¿síntomas físicos del embarazo, tales como vómitos, hinchazón de los pies, o dolores de espalda?

0 = Ahora no 1 = Algunos 2 = Mucho

9. ...¿la calidad de su atención médica durante su embarazo?

0 = Ahora no 1 = Algunos 2 = Mucho

10. ...¿si el Zika tendrá efectos inmediatos y/o efectos largo plazo sobre la salud y el bienestar de su bebé?

0 = Ahora no 1 = Algunos 2 = Mucho

11. ... ¿trabajando o cuidar de su familia durante su embarazo?
 0 = Ahora no 1 = Algunos 2 = Mucho
12. ...¿si el bebé podría verse afectado por el alcohol, cigarrillos o medicamentos que usted ha consumido?
 0 = Ahora no 1 = Algunos 2 = Mucho

Repita en segunda y tercera tiempo:

Se siente enojado, molesto o preocupado en este momento de su embarazo sobre:

13. ...¿si el bebé podría llegar demasiado pronto?
 0 = Ahora no 1 = Algunos 2 = Mucho
14. ...¿porque usted está teniendo un bebé, su relación con otros cambios?
 0 = Ahora no 1 = Algunos 2 = Mucho
15. ...¿el pago de la ropa del bebé , los alimentos o atención médica?
 0 = Ahora no 1 = Algunos 2 = Mucho

Añadido al tercera vez:

Se siente enojado, molesto o preocupado en este momento de su embarazo sobre:

16. ... ¿el cuidado de un bebé recién nacido?
 0 = Ahora no 1 = Algunos 2 = Mucho
17. ...¿dolor durante el parto?
 0 = Ahora no 1 = Algunos 2 = Mucho
18. ... ¿lo que sucederá durante el parto?
 0 = Ahora no 1 = Algunos 2 = Mucho
19. ...¿trabajar en un empleo después de que nazca el bebé?
 0 = Ahora no 1 = Algunos 2 = Mucho
20. ...¿quien ayudar lo hara cuidar al bebé después de su llegada?
 0 = Ahora no 1 = Algunos 2 = Mucho

Appendix M Sample Phase II Postpartum Interview Guide with Patient Reported Outcomes (English)

Postpartum Exit Interview Guide

To be used as a guideline for interviewing the participants.

Interview Introduction

- Interview will be coordinated with the participant in-person, by telephone or email.
- Participants will have been consented prior to interview time but will be reminded that they may be identifiable based on the small sample and region of the study. The demographic survey will also be completed prior to the interview.
- Discuss the purpose of audio recording and explain any associated technical issues that may occur during the interview.
- Explain that:
 - The participant can stop at any time (reiterate from consent form) and terminate their involvement in the study or reschedule if they are interested in continuing in the project.
 - Participants are also welcome to request the cessation of audio recording or to have information erased from record if they change their mind about disclosing specific information. This request can occur during the interview or after the interview has ended. The participant can contact the student researchers to remove this information from the record.
 - The student researcher will explain that they are interested in learning more about women's experiences of pregnancy and birth and how this relates to their completed surveys of general and pregnancy stress they complete three different times during pregnancy. The student researcher may ask participants to clarify or expand on some aspect of their narrative within the course of the interview and intends on being active listener.

Intake Questions:

Script: Thank you for answering questions about your pregnancy and birth. If you feel uncomfortable or do not want to answer any of the interview questions at any point during the interview, please let me know and we can move on to the next question.

To begin I'd like to ask some initial questions about your pregnancy, birth, and postpartum experience:

Estimated Due Date (EDD):

How was your EDD measured?:

Birth date of baby:

Birth weight of baby:

Sex of the baby:

How was the baby delivered (either vaginally or C-section):

How many weeks pregnant were you at the time of delivery?:

Post-partum weight:

Method of feeding:

Intake Questions:

Script: Thank you for describing your most experience of pregnancy and birth. If you feel uncomfortable or do not want to answer any of the interview questions at any time during the interview, please tell me and we can go to the next question.

Reflecting on the Pregnancy:

Now that you are postpartum, how do you feel about your pregnancy?

- Post Question Probe:
 - What were some of the best things about your pregnancy?
 - What were of the challenging things about your pregnancy?
 - If you could change things about your pregnancy, what would you change? What would you keep the same?

How was this pregnancy similar or different from previous pregnancies or your expectations of pregnancy?

- Post Question Probe:
 - What contributed to these similarities and differences?
 - How has this influenced your future family planning decisions?

Reflecting on Cohen Perceived Stress Scale Responses (as necessary):

(Cohen Perceived Stress Scale: Repeat as necessary for any survey question where participant indicated “fairly often” or “very often” – indicating a high level of stress in the last month)

In (*specific trimester or trimesters*) you indicated that you were experiencing these specific feelings and thoughts (*revise based on the question*) either fairly often or very often over the last month.

What caused you to experience these specific feelings so frequently or more often during that month?

- Post Question Probe:
 - How was this month different from other months in your pregnancy when you did not complete this survey?
 - How are these feelings and thoughts similar or different from when you are not pregnant?
 - How do you think these feelings or thoughts affected you during your pregnancy?
 - How do you think these feelings or thoughts affected your baby during your pregnancy?
 - How do you think these feelings and thoughts affected your birth outcomes?

(Cohen Perceived Stress Scale: Repeat as necessary for any survey question where participant indicated “never” or “almost never” – indicating a high level of stress in the last month)

In (*specific trimester or trimesters*) you indicated that you were experiencing these specific feelings and thoughts (*revise based on the question*) either never or almost never over the last month. What caused you to experience these specific feelings so infrequently or less during that month?

- Post Question Probe:

- How was this month different from other months in your pregnancy when you did not complete this survey?
- How are these feelings and thoughts similar or different from when you are not pregnant?
- How do you think this affected you during your pregnancy?
- How do you think this affected your baby during your pregnancy?
- How do you think this affected your birth outcomes?

Reflecting on Revised Prenatal Distress Scale Responses (as necessary):

(RPDQ Scale: Repeat as necessary for any survey question where participant indicated “very much” – indicating a high level of stress in that moment.)

In (*specific trimester or trimesters*) you indicated that you were experiencing these specific feelings and thoughts (*revise based on the question*) very much at that time.

What caused you to experience feelings of bother, upset or worry in that moment?

- Post Question Probe:
 - How is this similar or different from when you are not pregnant?
 - How did this affect you during your pregnancy?
 - How did this affect your baby during your pregnancy?
 - How did this affect your birth outcomes?
 - Overall, how often did you experience these (specific feelings about specific issue) in your pregnancy?

(RPDQ Scale: Repeat as necessary for any survey question where participant indicated “not at all” – indicating a high level of stress in that moment.)

In (*specific trimester or trimesters*) you indicated that you were experiencing these specific feelings and thoughts (*revise based on the question*) not at all at that time.

How were you able to reduce/eliminate feelings of bother, upset or worry in that moment?

- Post Question Probe:
 - How is this similar or different from when you are not pregnant?
 - How did this affect you during your pregnancy?
 - How did this affect your baby during your pregnancy?
 - How did this affect your birth outcomes?
 - Overall, how often did you feel (this way about this specific issue) in your pregnancy?

What are your thoughts about these stress surveys, as a measure of prenatal stress?

- Post-Question Probes:
 - How useful were these surveys for thinking about stress in your pregnancy?
 - What would you change or improve about these surveys?
 - What other ways would ask pregnant women about stress?

Birth Reflection Questions:

Now that you are postpartum, how do you feel about you labor and birth?

- Post Question Probes:
 - What were some of the best things about your labor and birth?
 - What were of the challenging things about your labor and birth?

- If you could change things about your labor and birth, what would you change? What would you keep the same?
- What emotions were you feeling during the birth and immediately postpartum?

How was this labor and birth similar or different from previous births or your expectations of birth?

- Post Question Probes:
 - What contributed to these similarities and differences?
 - How has this influenced your future family planning decisions?
 - How have your expectations of labor and birth changed?

Motherhood and Postpartum Questions:

How do you feel now that you are a mother to a new baby?

- Post Question Probes:
 - How have you adjusted to motherhood?
 - How have you adjusted to having a new member of the family?
 - How are these emotions different from previous experiences or your expectations of motherhood?

How do you feel your pregnancy and labor and birth experience have affected your feelings and experiences postpartum?

- Post Question Probes:
 - How do the feelings, emotions, and experiences you had in pregnancy and labor and birth reflect how you feel postpartum?
 - How do the feelings, emotions, and experiences you had in pregnancy and labor and birth do not reflect how you feel postpartum?
 - What makes you feel healthy and happy during this time?
 - What makes you feel unhealthy or upset during this time?

How does stress affect your life postpartum?

- Post Question Probes:
 - What causes you to feel more or less stressed now that the baby is here?
 - How have your perceptions or experiences of stress changed since the birth of your baby?
 - What are you doing to help reduce or eliminate that stress?

Closing Question:

Is there anything else you would like to share about your pregnancy, labor and birth, stress, and/or your postpartum experience?

Thank you for taking the time to participate in this interview! If you have any questions or would like something you said to be removed from the record, please contact Holly Horan at (319) 429 – 3758 or horanh@onid.orst.edu.

Appendix N Sample Phase II Postpartum Interview Guide with Patient Reported Outcomes (Spanish)

Guía de Entrevista Postparto

Para ser utilizado como una guía para entrevistar a los participantes.

La Introducción de la Entrevista

- Entrevista será coordinado con el participante en persona, por teléfono o correo electrónico.
- Los participantes han dado su consentimiento antes de la entrevista y se les recordó que puedan ser identificados con base en la pequeña muestra y la región del estudio. La encuesta demográfica también se completará en el comienzo de la fase II.
- El estudiante investigador discutirá el propósito de la grabación la entrevista y explicar los problemas técnicos asociados que pueden ocurrir durante la entrevista.
- Ella va a explicar que:
 - El participante puede parar en cualquier momento (repetición del formulario de consentimiento) y poner fin a su participación en el estudio o reprogramar si quieren continuar con el proyecto.
 - Los participantes pueden solicitar para detener la grabación de la entrevista o tener información eliminado de la entrevista si cambian de opinión acerca de compartir información específica. Esta petición puede ocurrir durante la entrevista o después de la entrevista ha terminado. El participante puede ponerse en contacto con el investigador del estudiante para eliminar esta información de la entrevista.
 - El estudiante investigador explicará que ella está interesada en aprender más acerca de las experiencias de las mujeres durante el embarazo y el parto y cómo esto se relaciona con sus encuestas completadas de estrés general y el embarazo que los participantes completaron tres veces durante el embarazo. El investigador estudiante puede pedir al participante que decirles más sobre alguna parte de su entrevista y la intención de ser un oyente activo.

Preguntas Preliminares:

Gracias por responder a las preguntas acerca de su embarazo y el parto. Si se siente incómodo o no quiere contestar ninguna de las preguntas de la entrevista en cualquier momento durante la entrevista, por favor dígame y podemos ir a la siguiente pregunta.

Para empezar, voy a hacer algunas preguntas preliminares sobre su embarazo , el parto y la experiencia post-parto:

Fecha probable de parto (Estimated Due Date (EDD)):

¿Cómo se midió la fecha probable de parto?:

Fecha de nacimiento del bebé:

El peso al nacer del bebé:

El sexo del bebé:

¿Cómo nació el bebé? (vaginal o cesárea):

¿Cuántas semanas de embarazo tenía usted cuando usted dio a luz?:

Su peso después del parto (ahora):

Método de alimentación:

Reflexionando sobre el Embarazo:

Ahora que está después del parto, ¿cómo te sientes acerca de su embarazo?

- Sonda Pregunta:
 - ¿Cuáles fueron las mejores cosas acerca de su embarazo?
 - ¿Cuáles fueron las cosas difíciles acerca de su embarazo?
 - Si pudiera cambiar las cosas acerca de este embarazo, ¿qué cambiaría? ¿Qué haría usted mantener el mismo?

¿Cómo era este embarazo similar o diferente de embarazos anteriores o sus expectativas de embarazo?

- Sonda Pregunta:
 - ¿Qué contribuyó a estas similitudes y diferencias?
 - ¿Cómo ha afectado esto a sus opciones de planificación familiar?
 - ¿Cómo han cambiado sus expectativas de embarazo?

Reflexionando sobre Cohen Escala De Estrés Percibido (como sea necesario):

(Cohen Escala De Estrés Percibido: Repita según sea necesario para cualquier pregunta de la encuesta donde participante indicó “casi siempre” o “siempre” – lo que indica un alto nivel de estrés en el último mes.)

En (trimester o trimestres específico) que indicó que estaban experimentando estos sentimientos y pensamientos específicos (basado en la pregunta) o bien “casi siempre” or “siempre” durante el último mes.

¿Qué causó a experimentar estos sentimientos con tanta frecuencia durante ese mes?

- Sonda Pregunta:
 - ¿Cómo fue este mes diferente de otros meses de su embarazo cuando no completó esta encuesta?
 - ¿Cómo son estos sentimientos y pensamientos similares o diferentes cuando no está embarazada?
 - ¿Cómo fue que te afectado por estos sentimientos y pensamientos durante el embarazo?
 - ¿Cómo fue tu bebé afectado por estos sentimientos y pensamientos durante el embarazo?
 - ¿Cómo fue tu nacimiento afectada por estos sentimientos y pensamientos?

(Cohen Escala De Estrés Percibido: Repita según sea necesario para cualquier pregunta de la encuesta donde participante indicó “nunca” o “casi nunca” – lo que indica un alto nivel de estrés en el último mes)

En (trimester o trimestres específico) que indicó que estaban experimentando estos sentimientos y pensamientos específicos (basado en la pregunta) o bien “nunca” o “casi nunca” durante el último mes.

¿Lo que causó a experimentar estos sentimientos menos durante ese mes?

- Sonda Pregunta:

- ¿Cómo fue este mes diferente de otros meses de su embarazo cuando no completó esta encuesta?
- ¿Cómo son estos sentimientos y pensamientos similares o diferentes cuando no está embarazada?
- ¿Cómo fue que te afectado por estos sentimientos y pensamientos durante el embarazo?
- ¿Cómo fue tu bebé afectado por estos sentimientos y pensamientos durante el embarazo?
- ¿Cómo fue tu nacimiento afectada por estos sentimientos y pensamientos?

Reflexionando sobre Cuestionario Revisado de Angustia Prenatal (como sea necesario):

(Cuestionario Revisado de Angustia Prenatal: Repita según sea necesario para cualquier pregunta de la encuesta donde participante indicó “Mucho” – lo que indica un alto nivel de estrés en el momento.)

En (trimester o trimestres específico) que indicó que estaban experimentando estos sentimientos y pensamientos específicos (basado en la pregunta) “Mucho” en ese tiempo.

¿Lo que causó a experimentar sentimientos de molestia, malestar o preocupación en ese momento?

- Sonda Pregunta:
 - ¿Cómo es esto similar o diferente de cuando usted no está embarazada?
 - ¿Cómo le afecta esto durante su embarazo?
 - ¿Cómo afectó esto a su bebé durante el embarazo?
 - ¿Cómo afectó esto sus resultados del parto?
 - En general, ¿con qué frecuencia experimenta estos sentimientos en el embarazo?

(Cuestionario Revisado de Angustia Prenatal: Repita según sea necesario para cualquier pregunta de la encuesta donde participante indicó “Ahora no” – indicating a low level of stress in that moment.)

En (trimester o trimestres específico) que indicó que estaban experimentando estos sentimientos y pensamientos específicos (basado en la pregunta) “Ahora no” en ese tiempo

¿Cómo fuiste capaz de reducir / eliminar sentimientos de molestia, malestar o preocupación en ese momento?

- Sonda Pregunta:
 - ¿Cómo es esto similar o diferente de cuando usted no está embarazada?
 - ¿Cómo le afecta esto durante su embarazo?
 - ¿Cómo afectó esto a su bebé durante el embarazo?
 - ¿Cómo afectó esto sus resultados del parto?
 - En general, ¿con qué frecuencia experimenta estos sentimientos en el embarazo?

¿Cuáles son sus pensamientos sobre estas encuestas de estrés, como una medida del estrés prenatal?

- Sonda Pregunta:
 - ¿Qué tan útiles eran estas encuestas para pensar en el estrés en el embarazo?
 - ¿Qué habría que cambiar o mejorar en estas encuestas?

- ¿Qué otras maneras le preguntaría a las mujeres embarazadas sobre el estrés?

Reflexionando sobre el Parto:

Ahora que está después del parto, ¿cómo te sientes acerca de ti el trabajo de parto?

- Sonda Pregunta:
 - ¿Cuáles son las mejores cosas de su trabajo de parto y el parto?
 - ¿Cuáles son las cosas difíciles acerca de su trabajo de parto y el parto?
 - Si pudieras cambiar cosas sobre su trabajo de parto y el nacimiento, ¿qué cambiaría? ¿Qué haría usted mantener el mismo?
 - ¿Qué emociones eran sentir durante el parto e inmediatamente después del parto?
 -

¿Cómo fue este el parto similar o diferente de los nacimientos anteriores o sus expectativas de nacimiento?

- Sonda Pregunta:
 - ¿Qué contribuyó a estas similitudes y diferencias?
 - ¿Cómo ha afectado esto a sus opciones de planificación familiar?
 - ¿Cómo han cambiado sus expectativas de parto y el nacimiento?

El estrés posparto:

¿Cómo afecta el estrés a su vida después del parto?

- Sonda Pregunta:
 - ¿Qué hace que usted se sienta más o menos estresado ahora que el bebé está aquí?
 - ¿Cómo han sus percepciones o experiencias de estrés cambiado desde el nacimiento de su bebé?
 - ¿Qué estás haciendo para ayudar a reducir o eliminar el estrés?

Ultima pregunta:

¿Hay algo más que quieras compartir acerca de su embarazo, el parto , el estrés y/o experiencia posparto?

Gracias por participar en esta entrevista. Si tiene cualquier pregunta o quiere quitar nada de la entrevista, por favor póngase en contacto con Holly Horan a (319) 429 – 3758 o horanh@onid.orst.edu.