ABSTRACT

Title of Dissertation: THE SELF-REPORTED HEALTH OF US WOMEN IN THE FIRST POSTPARTUM YEAR: NHANES 2007-2018

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Background: Most existing information about the health of US postpartum mothers comes from studies of morbidity and mortality. As a result, relatively little is known about the general well-being of postpartum mothers. Self-rated health (SRH), a single-item, 5-level ordinal measure has been widely used as an indicator of general health status in epidemiologic and population health research. There are no US population studies of maternal SRH in the postpartum period.

Methods: An analytic sample of 6,266 women ages 20-44 was created from the 2007-2018 waves of the National Health and Nutrition Surveys. The 5-level SRH measure was dichotomized into "good" and "poor" levels and multivariate logistic regression analysis was used to characterize the relationship between postpartum status and SRH and to test whether parity, cigarette smoking, pregnancy, depression, sleep duration, tiredness/fatigue, obesity, history of c-section and breastfeeding status independently predict poor SRH in the sub-population of postpartum women (n=508).

Results: There is a significant relationship between postpartum status and SRH that is moderated by pregnancy status. For women who are not pregnant, postpartum status is associated with lower odds of poor SRH (OR 0.52, 95% CI, 0.34-0.79) while for women who are pregnant, postpartum status is associated with increased odds of poor SRH (OR 2.34, 95% CI 0.81-6.78), an association that did not reach statistical significance at a p=0.05 level. Having a high school education (OR 0.35, 95% CI, 0.13-0.95) breastfeeding (OR 0.22, 95% CI 0.10-0.52) were associated with lower odds of poor SRH, while being Hispanic (OR 3.51, 95% CI 1.20-10.27), tired (OR 2.40, 95% CI 1.08-5.57) or obese (OR 2.72, 95% CI, 1.35-5.56) were associated with higher odds of maternal report of poor health.

Discussion: Postpartum status is associated with better SRH. This is not the case; however, for women who are pregnant again in the first postpartum year suggesting that a short interpregnancy interval (IPI) is a threat to postpartum maternal well-being. Breastfeeding, on the other hand, is associated with a strong protective effect on maternal postpartum SRH. These results suggest a need for postpartum contraceptive and breastfeeding promotion efforts that focus on immediate impacts on maternal health. Maternal postpartum obesity and maternal tiredness also emerge as priority areas for maternal postpartum health promotion initiatives. Additional research on the postpartum experience of Hispanic mothers is warranted.

THE SELF-REPORTED HEALTH OF US WOMEN IN THE FIRST POSTPARTUM YEAR: NHANES 2007-2018

by

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Dedication

To mothers – particularly mine, hers and those who have granted me the amazing privilege of letting me midwife them into motherhood.

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As a midwife I cannot help but think of this dissertation process in terms of a long, obstructed labor that somehow, defying all sorts of obstacles, has ended up in the healthy birth of this bundle of words. I must start by thanking the primary midwife of this project, Edmond Shenassa, who throughout this protracted endeavor has provided, as good midwives do, a mix of encouragement and honest appraisals of progress (or, when appropriate, lack thereof) along with the suggestions and technical assistance to ensure that I could make it to the finish line. Midwives work in teams, and I must thank the rest of my faculty, including my Dissertation Committee members for their endless patience and support even when my labor fell off the labor curve. There is also no way I could have done this without the amazing team of real-life midwives I have the privilege to call my colleagues. Jenny, Leah, Jamie, Hayley, Becca, Lisa and Richelle keep the practice running and have been the best kind of oxytocin –inspiring me to keep pushing (sometimes with the help of chocolate, wine and pickle dip). I have also had a village of doulas, including my old and new Department Chairs, Hugh Mighty, who helped start this process by asking "Jen, when are you going to start your PhD?" and Chris Harman, who helped bring it to a conclusion by asking, "Jen, when are you going to finish your PhD?" and my friend and colleague, Jan Kriebs, who helped me traverse the immense distance between those two questions. Thank you to my parents, my in-laws and my friends for the million supportive gestures; and to my daughters, Ana and Ellie, who for nearly a decade of their young lives have shared their mommy with her crazy job, her studies and now with this massive science project. Finally, to Sean, who has been there for

every minute of all my labors, tending to my every need with so much thoughtfulness and tenderness, and making sure I did not give up, even when I have been absolutely convinced that I could not keep going.

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Chapter 1: Introduction

Background

The postpartum, or puerperium, is typically defined using medical criteria as the 4-8 weeks following childbirth, which is the approximate time that it takes for women's reproductive organs to return to a non-pregnant state and for other pregnancy-induced changes in maternal anatomy and physiology to reverse.[1,2] A woman's postpartum transition, however, is impacted not only by the body's intrinsic capacity to return to a non-pregnant state and the speed of physical recovery from childbirth but also by a woman's ability for mental and social adaptation, including adaptation to the maternal role.[3,4] Increasing evidence highlights the postpartum period as a critical time for mothers, setting the stage for their and their infants' long-term health and well-being.[5,6] Optimizing women's health during the entirety of this complex transition is, therefore, a necessary part of any national maternal health strategy.[7–10] However, until recently, the postpartum had remained a relatively neglected period in public health research and intervention.

For much of the 20th century, based on the implicit assumption that 'what is good for the child will be good for the mother,' global maternal child health (MCH) efforts became nearly exclusively focused on infant and child mortality.[11] This shift of focus, however, was not good for mothers. In 1985, the Lancet published a landmark commentary calling attention to the "neglected tragedy" of maternal mortality and describing the preventable nature of most of the approximately 700,000 maternal deaths occurring globally each year.[11] The authors boldly asked, "Where is the M in MCH?"; a question that helped galvanize international efforts to prevent the deaths of women during pregnancy and childbirth.[12] This consorted international focus on the health of mothers has achieved a measurable reduction in the global burden of

maternal mortality (Hogan et al., 2010).[13] Since 1990, the maternal mortality ratio has declined by 45% worldwide.[14] However, in a period during which many of the world's countries were focusing on maternal mortality reduction efforts, the general assumption in the US was that an ''irreducible minimum'' had been reached beyond which there could be no further reduction in maternal mortality.[15] The MCH community in the US thus turned its attention away not only from maternal mortality reduction efforts but maternal health efforts altogether.[15,16] Unsurprisingly, therefore, the US did not see the gains in maternal health documented globally. Instead, the US maternal mortality rate not only stopped falling but increased 26% between 2000 and 2014.[16–18]

In the first part of this century, interest in maternal health re-emerged in the public health arena with the emergence of the life-course as a central health framework for MCH, a fundamental tenet of which is that experiences in-utero or early in life can be expressed symptomatically later in life, both as childhood and adult disease.[19] In this context, maternal health is treated as a determinant of in-utero fetal exposures that can impact an individual's entire health trajectory. As a result, MCH efforts became focused on enhancing women's health in the preconception period and during pregnancy. However, these maternal health activities have been directed primarily at improving neonatal and infant health outcomes rather than on improving maternal health for its own sake.[15,20] It is not until recently, sparked by a ProPublica report on the unsettling upward trends in US maternal mortality[21], that there has been a significant shift in the approach to maternal health – one in which a mother's health is considered for its own sake and not only as it impacts future reproductive capacity or the health of her infant and child. There is now renewed focus on maternal health initiatives.[20] The current predominant approach of these initiatives, both clinically and in the public health arena, is to work on

mortality and morbidity reduction in the childbirth and peripartum period through hospital-based, clinical interventions to address the most common immediate causes of severe maternal morbidity and death in the peripartum period such as obstetric hemorrhage, hypertensive disorders, thromboembolism, and peripartum cardiomyopathy.[20,22,23]

It is just in the past few years that advocates for postpartum maternal health have successfully brought the importance of the postpartum period into clinical focus.[5,8,24–26] Similarly, in the public health arena, an effort to better understand the circumstances surrounding pregnancy-related deaths in the US has unveiled that 1 in 3 (33%) pregnancy-related deaths occur 1 week to 1 year postpartum.[27] As a result, the CDC has called for maternal morbidity and mortality reduction efforts that purposefully target not just the peripartum period but the entire first postpartum year. While this new focus on the postpartum is critical to maternal health, national efforts remain clinically-focused and motivated primarily by efforts to understand and reverse severe maternal morbidity and mortality.[5,28] These efforts are critical but they focus on the small subset of high-risk individuals and do not address the subclinical and non-clinical health needs of all women transitioning into motherhood. Truly responding to the calls for a renewed commitment to maternal health and well-being[8] will require a more holistic health promotion approach

Postpartum Health Concerns of US Mothers

There is relatively limited knowledge about the general health of US women in the postpartum to guide clinical and public health initiatives.[15,26,29] Existing evidence suggests a high prevalence of mostly subclinical health concerns, many of which appear or persist well beyond the 4-8 weeks that demarks the medically defined postpartum period. An estimate of the prevalence of health concerns for US women in the year following childbirth comes from a

survey of 1323 women who received prenatal care at 9 community health centers in Philadelphia.[30] This survey, conducted at 9-12 weeks postpartum, was part of a larger CDC and NICHD funded prospective, community-based study. More than two-thirds (69%) of the women reported experiencing at least one physical health problem since childbirth. Forty-five percent reported at least one health concern of moderate or major severity. The number and severity of postpartum health problems (morbidity burden) correlated with reports of functional limitations (43.5% for those with high morbidity burden compared with 9.3% for those with no morbidity burden, $p < 0.001$) and depressive symptomatology (34.8% for those with high morbidity burden compared with 16.8% for those with no morbidity burden, $p < 0.001$).

The "Listening to Mothers" (LTM) III survey, a nationally representative sample of English-speaking U.S. women who gave birth to a singleton in hospitals from 2011 to 2012 (n= 2400), provides additional information on the prevalence and nature of health concerns of postpartum mothers in the US.[31] Mothers were provided with a list of 16 conditions and asked if they had experienced these as a new problem in the first two months after birth and if so, whether as a major or minor problem.

Common problems of new postpartum onset included sleep loss (58% overall, 21% major), feeling stressed (54%, 17% major), physical exhaustion (51%, 16% major), sore nipples/breast tenderness (48%, 12% major), backache (46%, 12% major), weight control (45%, 16% major), and lack of sexual desire (43%, 13% major).

The existing evidence "strongly suggests that postpartum physical health problems are common, salient, and cumulative, and negatively influence the quality of life of women following parturition."[30(p186)] These studies also document the persistence of postpartum health concerns well into the first year postpartum.[31,32] At six or more months after birth, 34% of US

mothers indicated they were still feeling stressed, 30% reported problems with sleep loss, and 29% were experiencing continuing problems with weight control. Approximately 1 in 4 reported physical exhaustion (27%), backache (26%), and lack of sexual desire (24%). Thirty-seven percent of women reported their postpartum physical health interfered with their ability to care for their baby.[31]

Despite the high prevalence and persistence of health concerns, there is poor attendance by many women of routine postpartum visits,[5,33] and general healthcare seeking by postpartum women for health concerns is low.[31,34,35] Few women seek professional help for their postpartum problems, even when they describe these as major or as interfering with newborn care, relationships, and activities of daily living, or when the concerns are still present many months following childbirth.[31] Excluding infections, for which approximately half of women (51-58%) sought help from a health professional, the vast majority of US women (72-90%) never consulted a health professional for other health concerns.[35] This trend has been identified in subsequent LTM surveys.[31] There are no large studies that have specifically studied why women in the US do not seek care for most of their postpartum health problems. However, results from a small qualitative (n = 87) study suggest that women in the US forgo care in the postpartum period not because they do not need or desire help, but rather due to barriers to healthcare-seeking behaviors in this time.[26] Among these barriers is a perception that it is inappropriate to ask for professional help for non-acute symptoms such as exhaustion. However, although most of the problems identified in these studies of maternal health in the postpartum are not acute or life-threatening, their potential effects on daily life - from childcare to household responsibilities to intimate relationships and employment - are not inconsequential for mothers.[7,26,36]

The development and implementation of successful interventions to meet the unique health and healthcare needs of US women in the postpartum period require not only an understanding of the nature of specific health concerns of women during this time, but also a better comprehension regarding the health status of postpartum mothers at the population-level. The paucity of population-level research has been identified as a limitation to national efforts to improve maternal postpartum health.[26,29,37] A lack of maternal health measures, particularly those that can be assessed at a population level, is one factor contributing to this comparative dearth of informative data. Maternal mortality rate (MMR) and, more recently, severe maternal morbidity (SMM) have been the primary population-level indicators of maternal health.[38,39] These measures' popularity arises in part from the relative ease of collection and categorization of death and disease data.[40] The use of measures of morbidity and mortality to measure health, however, presents some inherent problems. Most notably, those arising from the fact that morbidity and mortality are health outcomes rather than measures of health.[41,42] . Mortality and morbidity are incomplete health measures, not only because they fail to measure preclinical or subclinical conditions, but because they do not capture the various components that detract from or contribute to this physical, mental and social well-being. Health, as we understand it now, is a changeable state resulting from a complex interplay of factors that include the social and economic environment, the physical environment, and individual characteristics and behaviors.[43] As underscored by the World Health Organization's definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[44(p100)], freedom from disease may be a component of health, but it does not define it nor does its presence exclude it.

Measuring Maternal Health

Self-rated health (SRH), also referred to as self-reported health or self-assessed health, is one example of a general health measure commonly used in health research. In what is now over four decades worth of studies conducted in many different countries and different age groups, including those in which mortality rates are low, the single-word response to the simple single-question, "How do your rate your own health?" has, with few exceptions, been demonstrated to be a significant predictor of mortality in numerous studies in diverse populations, languages, and cultures independently of known health risk factors and objective health measurements.[45–49] A meta-analysis of 22 cohorts (ranging in size from 463 to 701,547) quantified the relative risk of mortality as 1.92 (CI = 1.64, 2.25) for those reporting 'poor' rather than 'excellent' health status.[46] Self-reported health often outperforms objective health measures in predicting mortality and is thought to contribute unique information to epidemiologic studies not captured by standard clinical assessments or self-reported histories.[50,51] Self-reported health is also an independent predictor of morbidity and functional ability.[45,52,53] While many studies of SRH were conducted in populations over 65 years of age, those in younger populations have found SRH to be a predictor of disease status[54], healthcare utilization[51], objective health measures such as serological assays[54], health behaviors[55], and mortality[51,52,56,57] in adult, non-elderly populations as well. This ability of SRH to predict mortality combined with the ease and cost-effectiveness of the collection of SRH data that has contributed to its popularity as a health indicator in population health studies and led to its inclusion in most national health surveys, including the and National Health and National Health and Nutrition Examination Survey (NHANES) the National Health Interview Survey (NHIS).

Study Overview and Aims

While SRH has been used to measure postpartum health in other countries, currently there are no US population-based studies that characterize women's self-reported health status in the postpartum period. This study sought to describe the self-reported health status of women residing in the US in the 12 months following childbirth using results from the National Health and Nutrition Examination Surveys (NHANES). An analytic sample of 6,266 women ages 20 to 44 was created from participants in the last six waves of NHANES (2007-2008, 2009-2010, 2011-2012, 2013-2014, 2015-2016, 2017-2018) and used to determine

1) the patterns of self-reported health of US women of reproductive age;
2) whether postpartum status is independently associated with self-reported health among US women of reproductive age;
3) whether pregnancy moderates the relationship between postpartum status and self-reported health; and
4) whether in the first 12 months postpartum there is an independent relationship between SRH and common sociodemographic factors and selected health factors including breastfeeding, depressive symptoms, history of cesarean section, amount of sleep, tiredness, obesity, and smoking.

Descriptive analyses were used to assess the patterns of SRH among women ages 20-44 and test for differences between groups of women who were postpartum and those who were not. Logistic regression analysis was used to assess for an independent association between postpartum status and SRH and to explore whether pregnancy moderates this relationship. Logistic regression was also used to determine if specific sociodemographic and health factors are independently associated with SRH in the postpartum.

Chapter 2: Self-Rated Health

Overview

The costs and logistic difficulties associated with assessing the health of a population have led to the use of select indicators of health status that can be readily collected from large numbers of individuals with minimal expenditure of resources.[58,59] At a population level, these general health measures can be used to produce prevalence estimates and provide a method of monitoring the population's health and of assessing the likely demand for health care services and the need for health interventions. Self-rated health (SRH) - the single-item response to some version of the question "In general, would you say your health is excellent, very good, good, fair, or poor?" has become a common and accepted measure of general health in national health surveys, and by extension, public health research.[58,60] The popularity of SRH is due not only to its ease of administration, but also to its reliable ability to predict mortality and a variety of other health outcomes, which has led to its wide acceptance as a valid measure of health.[45,46,48,52,57,59] In addition to serving as a proxy for objective measures of health (albeit ones that researchers may not be able to reliably identify), SRH has long been understood as a distinct dynamic construct that captures not only illness and other clinically measurable factors, but also subclinical health conditions and a broad range of non-clinical factors.[48,60–62] This study uses SRH to study the health of the US population of postpartum women. The use of SRH for this purpose is informed by prior research assessing the strengths, and limitations of SRH as a health measure.

Construct Validity of Self-Reported Health

Establishing validity is typically the first step in the adoption of a health measure[58]; however, most of the literature devoted to understanding what is captured by SRH and how well

it is captured has been published after its acceptance as a valid measure of health and its widespread use for both research and health surveillance.[61,63] A significant challenge to establishing content validity for SRH stems from the challenge in defining health. Our current understanding of health is that it is not an absolute truth composed of finite and static immutable factors. In this context, the use of self-reported health is a pragmatic response to a concrete need to measure a dynamic, complex, individual and somewhat abstract concept. Given this lack of "gold standard" measurement of health that can be used to distinguish correct from incorrect responses to questions on self-assessment of health, the content validity of SRH as a measure has been established primarily by its consistent ability to predict mortality. For decades, however, there have been efforts to determine what is captured by SRH in order to understand why and how it performs so well in predicting health outcomes, and, more recently, simply to understand its characteristics as its own outcome.

Self-rated health differs from most indicators of health in that its origins lie in an active cognitive process not guided by formal, agreed rules or definitions.[60,61] When people answer the question "How would you rate your health?" they provide an answer that results from a complex and multilayered calculus that encompasses not only the presence or absence of physical illness or injury but also health behaviors, psychological and social well-being, trajectories in health over time as well as assessments of their ability and functioning compared to others of their age or to an expectation of what they should be able to do.[45,61,64–70] Additionally, their responses are contingent on their social experiences and reflect factors that are both consciously and unconsciously taken into account.[69] Responses include factors such as expectations, social support, isolation and optimism[60,62] that are difficult to objectively assess, but that we now understand to be important determinants of health outcomes.[43] In summary, when assessing their

own health, individuals appear to produce individualized formulations that incorporate biological, psychological, and social dimensions many of which may not be accessible to an external observer and thus may explain the capacity of SRH to outperform objective predictors of disease and death. The attractiveness of SRH as a population-level health indicator, particularly for research applying a health promotion framework, therefore, comes not only from the simplicity of its administration, but also from its apparent ability to subsume in a meaningful way the many complex factors beyond the presence or absence of disease that contribute to health.[60,62,67–69]

Reliability of SRH

This study uses an analytic sample of women in a narrow age band. Additionally, age was included as a control variable. Therefore, gender variations in reports of SRH are not relevant, and age effects should be minimized. However, potential variations in reports of SRH related to race/ethnicity and SES have to be taken into consideration.

Race/Ethnicity

While self-reported health is a strong predictor of morbidity and mortality across racial and ethnic groups,[45,71,72] there is evidence of racial-ethnic disparities in reports of SRH that must be taken into consideration when interpreting results across groups.[73–75] In a nationally representative sample of 9,499 US adults aged 20 years and older, 40.7% reported excellent/very good health, 37.2% moderate health and 22.1% fair/poor health.[74] Compared to non-Hispanic whites, Hispanics (OR 2.91, 95% CI, 2.28-3.71) and non-Hispanic blacks (OR 1.51, 95% CI,1.26-1.83) were more likely to report fair/poor health. These disparities persist after adjustment for sociodemographic factors and the presence of chronic health conditions. These findings are similar to those from an older study using a 1986-1994 NHIS nationally

representative cohort of 706,390 participants in which, at each age interval, a higher proportion of blacks, Native Americans, Hispanics and Asian-Pacific Islanders reported fair or poor health than did non-Hispanic Whites.[72] Investigators have suggested that differences in SRH may be a result, to some extent, of variations in how members of these groups interpret questions concerning health status rather than simply representing variations in "true" health status between various racial and ethnic groups.[75] This appears to be supported by some studies exploring the impact of race/ethnicity on the relationship between SRH and health outcomes.[76]

Studies on SRH among Latinos are a particularly relevant example of this phenomenon. As was outlined above, Latinos(as), on average, report poorer health status on self-assessments of health than non-Hispanic Whites and members of other ethnic groups.[76–78] This effect remains even after controlling for objective health indicators and socioeconomic factors.[79] Additionally, Latinx immigrants on average, rate themselves in poorer health than do longer-term immigrants, who, in turn, on average, report lower SRH than do native-born Latinos all of whom, on average, report lower SRH than non-Hispanic Whites. Theories for why Hispanics, especially those who are recent immigrants, are more likely to report poorer health are numerous and range from the relatively simple, such as the fact that the wording in Spanish version of the question seems more likely to elicit a negative response[80,81] to the comparatively complex, such as the possibility of increased somatization of emotional distress by Hispanics.[81,82] Mortality rates, however, are lowest for recent Latino immigrants and highest for native-born Latinos whose mortality rates are similar to non-Hispanic Whites.[83] This has given rise to theories of acculturation as a moderator of the relationship between SRH and mortality.[81,82] A study of Latinx adults (n = 37,713) living in the US examined the relationship between acculturation status, SRH and mortality at various time points using National Health Interview Survey data

linked to Multiple Cause of Death data.[76] In this population, the strength of association between poor SRH and mortality risk seemed to increase with levels of acculturation. Poor SRH either failed to predict or was a weak predictor of subsequent mortality risk among the less acculturated.

While multiple studies have found that reports of SRH may vary by race/ethnicity, other studies provide evidence that in some circumstances SRH can be used for cross-group comparisons.[71,72,84] A study using a large nationally representative, longitudinal sample of US adolescents and young adults (n = 17,934) was designed specifically to test whether the relationships between self-rated health and physical and mental health (measured by depressive symptoms, functional limitations, body mass index (BMI), and chronic physical conditions) were similar for adolescents of different racial/ethnic groups and immigrant generations.[84] Additionally, this study assessed whether the relationship between SRH and health status was stable across adolescence and into adulthood and examined whether a change in health status over time corresponded to a similar change in SRH groups. The researchers calculated R^2 scores for each group and tested for R^2 differences between groups. There were no statistically significant differences (at $\alpha < .05$) across racial/ethnic groups or immigrant generations in the amount of variance in self-rated health explained by mental and physical health indicators and the cross-sectional association between the health indicators and self-rated health did not vary across groups. In the longitudinal analysis, change scores predicted future self-rated health similarly across all groups with one exception – body mass index (BMI) was associated more negatively with later self-rated health for Asians than for Whites or Blacks.

Socioeconomic Status

There is evidence to suggest systematic differences between SES groups in the responses to SRH. With few exceptions,[56,85,86] studies suggest that, on average, SRH among those with more advantaged SES (whether measured by income or education) is more likely to predict subsequent morbidity and mortality [87–90] In the presence of the same condition, it is possible that people with higher education may experience a greater negative impact on their perceived health than those with lower educational levels. This would generate a stronger SRH-mortality association for those with higher SES.

A study of US non-Hispanic Black and White adults 25 and older (n=358,388) using National Health Interview Survey data linked to Multiple Cause of Death Files Interactions provides support to the theory that low SRH is more strongly associated with mortality for adults with higher SES (education and/or income) relative to those with lower SES.[91] Interactions of SRH and level of education and SRH and level of income were used to assess differences in the predictive power of SRH for subsequent mortality between groups with different levels of education and income Low SRH (poor/fair) was more strongly associated with mortality for adults with highest education (OR 3.65, 95% CI, 3.33-3.99) and top income quartile (OR 2.82, 95% CI, 2.67 - 2.98) than in those with the lowest educational attainment (OR 1.79, 95% CI,1.73-1.86) and bottom income quartile (OR 1.80, 95% CI, 1.73-1.87).

A similar effect seems to be present for morbidity. In a US representative sample of 4661 men and 4593 women, the relation between health status (measured as the presence of certain chronic health conditions) and SRH was modified by level of education.[87] Specifically, the association between health conditions and SRH was greater among more highly educated individuals. In women, after adjusting for age and ethnicity, functional limitations were associated more strongly with poor SRH in more highly educated women (OR, 8.73, 95% CI,

5.87-12.98) than in those with lower educational attainment. A similar study using a U.S. nationally representative sample of 13,877 adults aged 25 to 80 years aimed to overcome some of the potential bias in SRH studies related to the use self-reported conditions and functional limitations by testing whether education modified the association between SRH and 14 biomarkers representing metabolic, cardiovascular, inflammatory, and organ function.[88] The results support the possibility that SRH may not correspond to objective measures of health in the same way for different SES groups. In general, respondents with more education had healthier levels of biomarkers for the same level of SRH. Among women reporting ‘‘excellent’’ health, each additional year of education was associated with a 0.51-point reduction in systolic BP, a 1.5 decrease in total cholesterol, a 0.80 point increase in HDL cholesterol, and a 1.4% lower probability of unhealthy range of CRP.

SRH Stability/Test-Retest Reliability

A recent Norwegian study using repeated measurements and physical examinations of 11,652 men and 12,684 women demonstrated that SRH still predicted mortality 15–20 years after the question was answered albeit not as well.[62] At 0-5 years following SRH assessment, nearly 4 times the number of those who had rated their SRH as poor died as those who had better SRH (HR 3.63, 95% CI 2.30-5.73). At 15-21 years after the SRH assessment, more of those who had rated their health as poor died, albeit at a smaller ratio to those that had rated their health as better (HR1.58, 95% CI, 1.21-2.06). The fact that SRH predicts mortality risk 15-20 years after it was assessed suggests that despite its subjective nature SRH captures core and persistent information about an individual’s health.

There has only been one US-based study on the consistency of SRH over time.[64] This study evaluated the test-retest reliability of SRH a nationally representative sample of 9,235

adults interviewed in the 2005–2008 National Health and Nutrition Examination Survey (NHANES) and found that 40% of respondents changed their health rating between interviews one month apart, indicating moderate to somewhat strong test-retest reliability of SRH. Nonwhite minorities and adults with less education had lower reliability of SRH judgments. However, most of those who changed their score did so by only 1 level. When the 5-level SRH was dichotomized, fewer than 11% of respondents changed categories between interviews. Dichotomization of the 5-point scale, therefore, is a useful strategy for increasing the reliability of SRH in the general population. Given that this study is a cross-sectional study, these results mostly serve to underscore the need to be mindful of the possibility of systematic difference in SRH assessments across race/ethnic and SES groups when interpreting SRH differences between groups.

Implications for the Current Study

The goal of this study was to provide novel information regarding the health of US mothers in the first year postpartum beyond what is provided by those that use the traditional measures of morbidity and mortality. Collectively, the literature on SRH as a measure of health provides extensive evidence that SRH captures relevant information about the health status of individuals and populations beyond the presence or absence of disease. This literature also reveals systematic differences in how SRH is interpreted by members of different racial/ethnic or SES groups some of which may not represent "true" variations in health that signal a need for caution when using SRH as a measure of health disparities. However, it is also important to note that an individual's assessment of their health as poor may signal the presence of factors such as discrimination,[92,93] social isolation[94] or social disadvantage[95] that are may not be evenly distributed across racial/ethnic and SES groups. These types of factors have important impacts

on health that may not be clinically detectable or that may take a long time to become clinically detectable. In this way, SRH may be a particularly powerful tool for population health research as it may help illuminate populations with compromised health that may otherwise go undetected.[62]

The use of SRH in this study was undertaken with an awareness of its strengths and limitations, including the potential for systematic differences in SRH reporting which were taken into consideration when constructing regression models and interpreting study results.

Chapter 3: Literature Review

I conducted a scoping review of the literature to determine what is already known regarding the epidemiology of maternal self-reported health (SRH) in the postpartum period (defined for this review as up to 24 months following childbirth). The databases PubMed, CINAHL, SocIndex and PsyINFO were searched for research reports published between 2000 and 2020 using the following search terms (in all fields): ((postpartum OR "following childbirth" OR "following birth" OR maternal or "after childbirth" OR "after birth" OR "following pregnancy" OR "after pregnancy")) AND ("self-rated health" OR "self-reported health"). The 488 items retrieved were de-duplicated leaving 313 unique items. The same search was then conducted in EMBASE. Nearly all (208 of 209) EMBASE results had been identified in the previous search, so adequate coverage of the literature was assumed.

After removing duplicates, studies not in English and studies published before 2000, the titles and abstracts of the remaining studies were reviewed to determine if they should be included using the criteria described in Table 1. The reference lists of the selected articles were reviewed to identify any additional studies that should be included in the review. Figure 1 summarizes the results of the search that encompasses literature from 2000-2020.

The review yielded 22 studies [96–117] (21 quantitative and 1 qualitative) from 11 countries. The study design and results of these studies are summarized in Table 2.

Table 1. Scoping Review Inclusion/Exclusion Criteria

Criterion	Inclusion	Exclusion
Type of Publication	Original, published studies	Editorials, commentaries, non-published studies
Type of Study	Observational studies	Experimental/intervention studies
Exposure (Postpartum Status)	Population of postpartum women (up to 24 months post childbirth) can be identified, even if the study did not specifically focus on the postpartum	Studies in which postpartum status of women could not be determined
Outcome (SRH)	SRH assessment identifiable as single-item assessment (single question, single answer). Maternal SRH assessed at least once during the first 12 postpartum months Maternal SRH results used to assess maternal health or maternal-related outcome (e.g. breastfeeding).	SRH not reported or reported as part of an index or composite measure and not identifiable as single item/single answer Maternal SRH assessed only in pregnancy or not assessed at least once during the first 12 postpartum months Maternal SRH included but not used to assess maternal health or maternal related outcomes/relationships
Other	.	Sample restricted to a subset of mothers (e.g., only mothers with diabetes; only breastfeeding mothers; only mothers of infants in NICU)

Nearly half the studies were conducted in either the US [97,100–102,104] or Sweden[99,108–111]. None of the US studies used a nationally representative sample. Most of the studies[96,99,100,102–106,108–112,114,117] (68%) used a 5-item SRH scale; 6 of them[97,98,107,113,115,116] used a 4-item scale; and 1 study[101] did not specify whether a 4 or 5-item scale was used. In the majority of the studies(68%)[96,98,99,102,105,106,108–110,110,112–116] SRH was dichotomized for the purpose of multivariate regression analysis. In all but one[114] this dichotomization followed standard treatment of SRH in the literature (grouping "fair" and "poor" under one category and "good", "very good" and "excellent" into another). In the one study where this was not the case,[114] the researchers purposefully chose to include the response of "good" along with "fair" and "poor"

rather than with “excellent” and “very good”. This was done due to the skewedness of reports of SRH towards positive but limits the comparability of this study.

Figure 1. Flow Diagram of Scoping Review of Literature on SRH in Postpartum Period

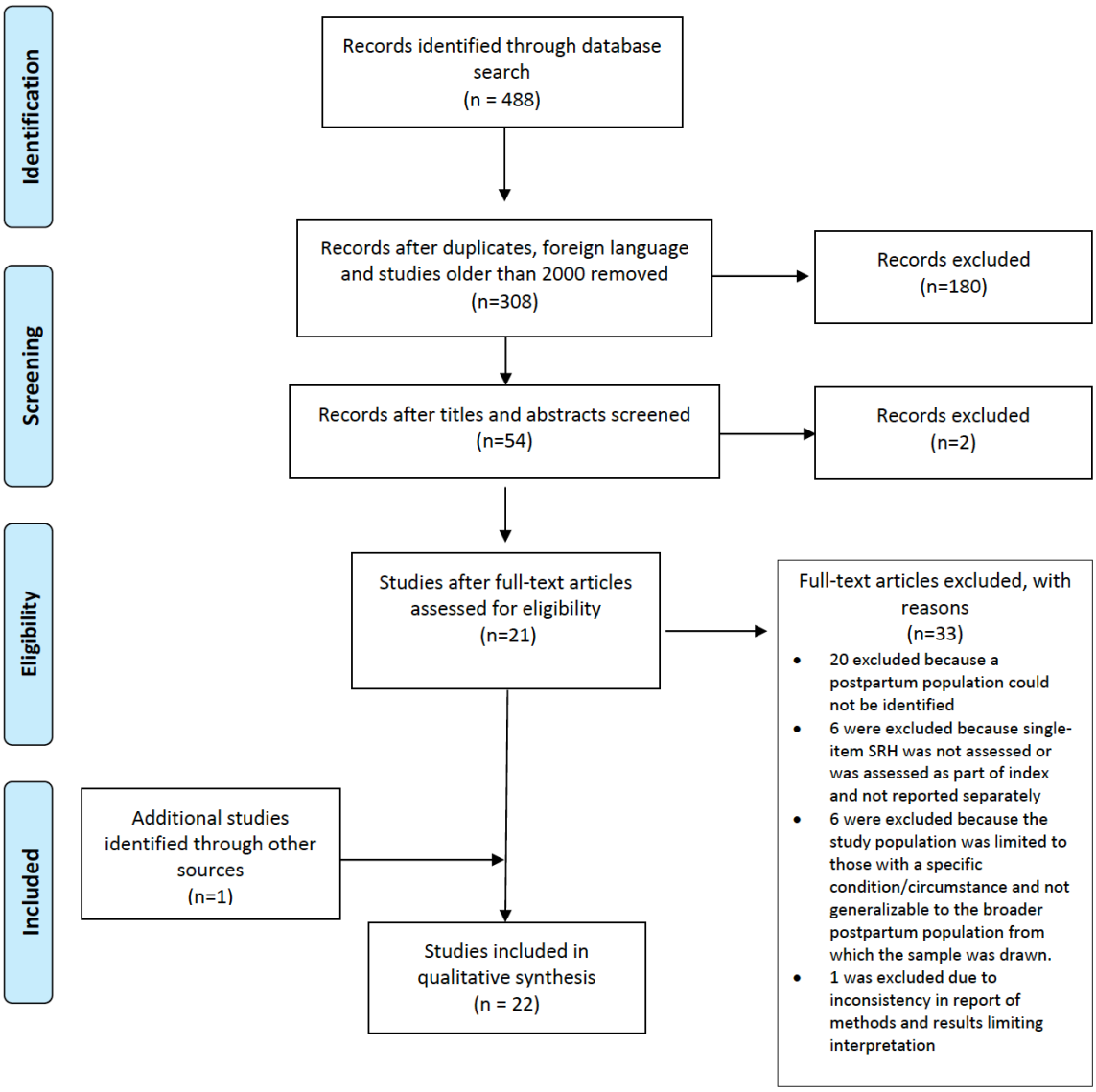


Table 2. Summary of Scoping Review Results: SRH and Maternal Health in the 24 Months Following Childbirth

Author(s)/(Year) **Country** **Study Population**	**SRH Description: Measure, Assessment, Prevalence** **SRH Aims** **SRH Findings**
Aksu, Varol & Sahin[96] (2016) Turkey Sample of 400 women drawn from a population of 3950 who gave birth in any of the obstetric clinics in the provincial center of Edime in the year preceding the study (2007)	*SRH Measure:* 5-item; dichotomized to "well" (very well/well) *and* "poor" (fair/poor/very poor) *SRH Assessment:* 0-6 weeks, 6 months and 12 months *SRH Prevalence:* Poor = 0-6 weeks 40.0%; 6 months 31.7%; 12 months 19.8% *SRH-Related Aim(s):* Determine the relationship between physical health problems and poor health perception of participants *SRH-Related Results:* At 6 weeks, fatigue (OR 13.66, 95% CI, 5.35-34.87) and abdominal pain (OR 2.14, 95% CI, 1.22-3.75) were associated with poor SRH. At 1 year, nipple pain (OR 4.30, 95% CI, 1.18-15.6); nipple fissure (OR 6.64, 95% CI, 4.04-68.46); pain at operation site (OR 2.36, 95% CI, 1.16-4.81) and flatus incontinence (OR 3.17, CI, 1.07-8.67) were associated with poor maternal SRH.
Buehler & O'Brien[97] (2011) United States 1364 mothers recruited in 1991 during childbirth hospitalization in 10 US locations as part of the NICHD Study of Early Child Care and Youth Development	*SRH Measure:* 4-item (poor, fair, good, excellent) *SRH Assessment:* 6 and 15 months postpartum (and at 5 other points >24 months postpartum not included here) *SRH Prevalence:* Not reported *SRH-Related Aim(s):* To determine if women who are employed part time have better health than mothers who are not employed. *SRH-Related Results:* At 6 months, mothers who worked part time had better self-reported health than mothers who were not employed ($t= -2.34$; $F [2, 1351] = 4.81$; $p <0.05$). Mothers employed part time and full time did not differ on SRH.

El-Khoury et al.[98] (2018) France Sample of 17,988 mothers who gave birth in 2011 recruited from representative random sample of 320 maternity wards throughout France	*SRH Measure:* 4-item, dichotomized to "bad" (average/bad) *and* "good" (good/very good) *SRH Assessment:* 2 months postpartum *SRH Prevalence:* Bad = 7.5% *SRH-Related Aim(s):* Association between migrant status and postpartum depression and self-rated health. *SRH-Related Results:* Non-naturalized migrant women more likely to report being in poor health at 2 months postpartum (OR 1.45, 95% CI, 1.06-1.98) compared to the majority of the population
Fabian et al.[99] (2008) Sweden Sample of 3455 women drawn from a pool of 4600 recruited in 595 antenatal clinics in Sweden during one-year period (1999-2000) during early pregnancy and followed through one year postpartum. Participants had to be able to understand written Swedish.	*SRH Measure:* 5-item, dichotomized to "good" (very good/good) and "less than good" (neither good nor poor/poor/very poor) *SRH Assessment:* 1 year and 5 years postpartum *SRH Prevalence:* Less than good 13.6% women of Swedish-speaking background, 19.4% non-Swedish speaking background from rich country of origin; 28.3% non-Swedish speaking background poor country of origin *SRH-Related Aim(s):* Uptake of care and maternal and child health up to 5 years following birth of women of Non-Swedish speaking background (stratified by rich and poor country of origin) compared to reference group of women of Swedish-speaking background. *SRH-Related Results:* Women from a non-Swedish speaking background had higher relative risk (RR) of reporting less than good health at 1 year whether they were from a poor country of origin (RR 2.1, 95% CI 1.5-2.8) or rich country of origin (RR 1.4, 95% CI, 0.9-2.2)
Falletta et al.[100] (2019) United States Sample of 249 women who had given birth in the previous five years from a pool of 2322 women aged 50 and younger, who were employed as full time or part time, and who were in classified or unclassified positions (staff, faculty, and graduate assistants) within all colleges and	*SRH Measure:* 5-item (poor, fair, good, very good, and excellent) *SRH Prevalence:* 7.2% poor; 19.3% fair; 41.8% good; 22.9% very good, and 7.6% excellent *SRH-Related Aim(s):* Examine selected pregnancy, childbirth, and return-to-work correlates of overall self-rated health within the first month of work reentry after maternity leave. *SRH-Related Results:* Women who experienced depression (OR 0.096, 95% CI, 0.019 - 0.483) and anxiety (OR 0.164, 95% CI, 0.042 - 0.635) nearly every day reported worse health at work reentry than those with no symptoms. Controlling for demographics and mental health, women who experienced medical problems during pregnancy (OR 0.54, 95% CI, 0.31 -0 .94) were more likely to report poor health, while taking a longer maternity leave (OR 14.55, 95% CI, 4.93 - 42.92) was associated with reporting better health at work reentry.

departments at a large, public Midwestern university	
Haas et al.[101] (2005) United States 1809 women (of 2854 eligible) who were part of a longitudinal cohort of pregnant women receiving prenatal care at site affiliated with one of 6 delivering hospitals in the San Francisco Bay area	*SRH Measure:* Unspecified number of items, outcome of interest was *"*Poor"(fair/poor) *SRH Assessment:* Prior to pregnancy, during pregnancy, 8-12 weeks after pregnancy *SRH Prevalence:* Poor SRH 12.1% prior to pregnancy; 12.9% during pregnancy; 11% 8-12 weeks after pregnancy *SRH-Related Aim(s):* To characterize changes in health status experienced by multi-ethnic cohort of women during and after pregnancy *SRH-Related Results:* Episode of insufficient money (OR 2.06, 95% CI, 1.33-3.19), receiving inadequate social support (OR 1.75, 95% CI, 1.09-2.81), cesarean delivery (OR 1.76, 95% CI, 1.17-2.63) were associated with poor health status 8-12 months postpartum.
Henninger et al.[102] (2017) United States 1149 women who enrolled in Pregnancy and Influenza Project in two Kaiser Permanente regions (Northwest and Northern California) in 2010-2011	*SRH Measure:* 5-item, dichotomized as (excellent/very good), (good) *and* (fair/poor) for analysis *SRH Assessment:* following delivery, 1 month postpartum and 6 months postpartum *SRH Prevalence:* Fair/Poor 2.8% *SRH-Related Aim(s):* To determine which of a set of variables (including SRH) predict breastfeeding initiation and maintenance. *SRH-Related Results:* Odds of breastfeeding at 6 months were higher for women who rated their health as very good/excellent (OR 2.83, 95% CI, 1.2-6.8) than for those who rated their health as fair/poor.

Hughes, Gallagher & Hannigan[103] (2015) Ireland 11,134 mothers of infants drawn from a stratified random sample of infants registered in Child Benefit Register (registry of all children through 16 years of age in Ireland) born between May 2007 and December 2008	*SRH Measure:* 5-item, grouped as (excellent/very good), (good) *and* (fair/poor) for analysis *SRH Assessment:* 9 months postpartum *SRH Prevalence:* Fair/Poor 6.5% *SRH-Related Aim(s):* To characterize infant sleep patterns and explore relationship of infant sleep profiles and maternal health and well-being. *SRH-Related Results:* Maternal report of health was less positive in the less favorable infant sleep profiles: 9.4% and 8.2% report of fair/poor health in two less favorable sleep profiles vs. 6.0% and 5.2% reporting fair/poor health in two more favorable sleep profiles (P value <0.001).
Kim et al.[104] (2005) United States 1445 women (of 1657 eligible) who delivered at one of six San Francisco Bay area hospitals enrolled May 2001-July 2002).	*SRH Measure:* 5-item (excellent, very good, good, fair, poor). Change in SRH from pregnancy to postpartum status was study measure. *SRH Assessment:* Pre-pregnancy (retrospectively); 12-20 weeks' gestation; 8-12 weeks postpartum *SRH Prevalence:* Not reported *SRH-Related Aim(s):* To examine the effect of gestational diabetes mellitus and pregnancy-induced hypertension (PIH) on health status *SRH-Related Results:* After adjusting for age, race, education, pre-pregnancy weight, pre-pregnancy exercise level, parity, and prior history of PIH, women with pregnancy-induced hypertension were more likely to have a decline in SRH (OR 2.12, 95% CI ,1.19-3.77) from pregnancy to the postpartum period. This relationship was mediated by cesarean section (OR 1.99, 95% CI 1.11-3.57) and preterm delivery (OR 1.78, 95% CI, 0.98-3.24).
Lamarca et al.[105] (2013) Brazil 685 women with consistent SRH from pregnancy through postpartum from a pool of 1750 eligible participants recruited in first trimester of pregnancy from two cities in State of Rio de Janeiro from all women who sought antenatal care at the public	*SRH Measure:* 5-point dichotomized to "good"(excellent/very good/good) *and* "poor"(fair/poor) *SRH Assessment:* Baseline and 6 months postpartum *SRH Prevalence:* Poor SRH 12.8% (of those who had consistent SRH at baseline and 6 months postpartum) *SRH-Related Aim(s):* Determine the association between neighborhood and individual social capital with SRH in women who had consistent SRH from pregnancy into postpartum period. *SRH-Related Results:* Poor SRH at baseline and postpartum was associated with lower levels of social support (OR 0.82, 95% CI, 0.73-0.90) and lower likelihood of friends in their social network (OR 0.61, 95% CI ,0.37-.99). Having <9 years of schooling (OR 2.06, 95% CI,1.15.-3.71); being Black (OR 2.11, 95% CI, 1.9-4.75) or

health care units administered by the National Health Care System in October 2008 through December 2009. Participants were stratified by SRH.	"Brown" (OR 2.02, 95% CI, 1.07 – 3.85); reporting UTI (OR 2.11, 95% CI, 1.28-3.49); having 2 or 3 children (OR 3.23, 95% CI, 1.66-6.31) or 4 or more children (OR 3.39, 95% CI ,1.57-7.31 and plumbing outside of the house (OR 1.85, 95% CI, 1.05, 3.28).
Morgan & Eastwood[106] (2014) Australia 23,534 mothers in South Western Sydney who had live births between 2004 and 2006	*SRH Measure:* 5-item, dichotomized to "better"(excellent/ very good/good) *and* "worse"(fair/poor) *SRH Assessment:* 1 month postpartum *SRH Prevalence:* Worse SRH 3.7% *SRH-Related Aim(s):* Determine the relationship between maternal SRH and sociodemographic factors *SRH-Related Results:* Poor financial situation (OR 3.12, 95% CI, 2.05-4.72); public (OR 1.58, 95% CI, 1.10-2.27) or other (OR 2.12, 95% CI,1.32-3.43) housing; lack of access to a car (OR 1.29, 95% CI, 1.01-1.66); unplanned pregnancy (OR 1.65, 95% CI, 1.35 -2.03); lack of emotional support (OR 2.33, 95% CI, 1.77-3.06), support network of <3 people (OR 1.41, 95% CI 1.12-1.80); and motherhood being worse than expected (OR 2.12, 95% CI, 1.78-2.62) associated with worse SRH.
Petrou, Kupek & Gray[107] (2007) United Kingdom 18,523 birth mothers who were part of the first Millennium Cohort Study survey (one of UK longitudinal birth cohort studies) carried out between September 2000 and November 2001	*SRH Measure:* 4-item, dichotomized to excellent/good and fair/poor *SRH Assessment:* 9 months postpartum *SRH Prevalence:* Not reported *SRH-Related Aim(s):* Determine association between income status and self-reported health status in postpartum period. *SRH-Related Results:* Household income in the fifth quintile (top 20%) was associated with decreased odds of reporting fair or poor health (OR 0.72; 95% CI, 0.58–0.90). Being of age 36 or older (OR 1.30 ; 95% CI, 1.14–1.49); being of semi-routine/routine occupational social class (unskilled workers) (OR 1.22; 95% CI, 1.04–1.43); being of Indian (OR 1.92; 95% CI, 1.33–2.76) Pakistani (OR 1.81; 95% CI ,1.40–2.33), Black Caribbean (OR 1.97; 95% CI, 1.36– 2.85) or "other" (OR 1.68; 95% CI ,1.21–2.33) ethnic origin; past but not current employment status (OR 1.28; 95% CI, 1.14– 1.43); having an economically inactive partner (OR 1.15; 95% CI, 1.01–1.32); being a smoker of 1-10 cigarettes/day (OR 1.34 95% CI, 1.18-1.51), 11-19 cigarettes/day (OR 1.90 95% CI, 1.60-2.25), >20 cigarettes/day (OR 2.10, 95% CI, 1.74-2.53); and residing in a neighborhood of medium

	(OR 1.22; 95% CI 1.09–1.36) or high (OR 2.11; 95% CI 1.82–2.46) deprivation was independently associated with an increased likelihood of reporting fair or poor health status.
Schytt & Hildingsson[108] (2011) Sweden 1212 Swedish-speaking women enrolled in prenatal care during 2007 at 3 hospitals in North Middle Sweden recruited at 18 weeks of pregnancy and followed through 1 year postpartum	*SRH Measure:* 5-item, dichotomized to "good" (very good, good) *and* "poor" (neither good nor bad, bad, very bad). Emotional SRH and physical SRH examined separately. *SRH Assessment:* 18 weeks and 33 weeks pregnancy; 2 months postpartum and 1 year postpartum *SRH Prevalence:* Poor Emotional SRH 18 weeks 14.3%, 33 weeks 22.2%, 2 months postpartum 16.6% and 1year postpartum 23.9 Poor Physical SRH: 20.4%, 36.9% 19.9%, 33.7% *SRH-Related Aim(s):* Determine prevalence of poor physical and emotional SRH and determine factors associated with poor SRH *SRH-Related Results:* At one year postpartum, having had an emergency C-section (OR 2.2, 95% CI, 1.3-3.5) and being stressed about parenthood (OR 1.4, 95% CI, 1.0-2.1) was associated with poor physical SRH while less than a college education (OR 1.5, 95% CI, 1.1.-2.1) and dissatisfaction with partner support (OR 2.6, 95% CI 1.5-4.5) was associated with poor emotional SRH. Financial worries (OR 1.5, 95% CI, 1.1-2.1 and OR 1.8, 95% CI, 1.2-2.6) and having had an emergency C-section (OR 2.2, 95% CI, 1.3-3.5 and OR 2.1, 95% CI, 1.3-3.5) was associated with poor physical and poor emotional SRH, respectively.
Schytt, Lindmark & Waldenstrom[109] (2005) Sweden 2413 pregnant women recruited from all Swedish-speaking women who had their first antenatal visit in any of the antenatal clinical in Sweden during three 1-week periods over one year (1999-2000) and followed through 1 year postpartum	*SRH Measure:* 5-item; (very bad, bad, neither good nor bad, good, very good) For logistic regression dichotomized to (very good/good) and "fair/poor" (neither good nor bad/bad/very bad) *SRH Assessment:* 4-8 weeks postpartum and 1 year postpartum *SRH Prevalence:* Fair/poor 8.6% at 4-8 weeks and 14.3% at 1 year *SRH-Related Aim(s):* Determine the prevalence and number of physical symptoms at two months and one year postpartum and their association with SRH. *SRH-Related Results:* At 2 months postpartum, headache (OR 2.2, 95% CI, 1.6-3.1), sleeping problems (OR 2.0, 95% CI, 1.4-2.8), tiredness (OR 3.1, 95% CI, 1.9-5.0), low back pain (OR 1.7, 95% CI, 1.2-2.4), mastitis (OR 3.0, 95% CI, 1.2-7.3) and perineal pain (OR 1.8, 95% CI, 1.2-2.7) were associated with fair/poor SRH. At one year postpartum, headache (OR 1.7, 95% CI, 1.3-2.2), sleeping problems (OR 1.4, 95% CI, 1.1-1.9), tiredness (OR 3.3, 95% CI, 2.3-4.8), neck/shoulder pain (OR 1.8, 95% CI, 1.3-2.3), low back pain (OR 1.4, 95% CI, 1.1-

	1.9), dysuria (OR 2.0, 95% CI, 1.1-3.8), nausea (OR 2.0, 95% CI 1.4-2.8) and stomachache (OR 2.4, 95% CI, 1.8-3.3) were associated with fair/poor SRH.
Schytt & Waldenström[110] (2007) Sweden 2424 pregnant women recruited from all Swedish-speaking women who had their first antenatal visit in any of the antenatal clinical in Sweden during three, 1-week periods over one year (1999-2000)	*SRH Measure:* 5-item dichotomized to "good" (very good/good) *and* "poor"(neither good nor bad/bad/very bad)) *SRH Assessment:* 4-8 weeks and 1 year postpartum *SRH Prevalence:* Primiparas 7.6% poor SRH at 2 months and 13.8% at 1 year. Multiparas 9.3% poor SRH at 2 months and 14.5% at 1 year *SRH-Related Aim(s):* *SRH-Related Results:* Primiparas 2 months: tiredness (OR 5.8, 95% CI, 2.2-15.5), low back pain (OR 2.3, 95% CI, 1.3-4.2), perineal pain (OR 2.3, 95% CI, 1.2-4.5), EPDS score ≥12 (OR 5.9, 95% CI, 3.1-11.3), high degree of worry about relationships (OR 4.3, 95% CI 1.3-13.8) and mixed experience with breastfeeding (OR 2.2, 95% CI, 1.2-4.1) associated with poor SRH. Primiparas 1 year: history of unemployment (OR 1.9, 95% CI, 1.1-3.1), tiredness (OR 3.4, 95% CI, 1.9-6.2), nausea (OR 2.8, 95% CI, 1.5-4.8), abdominal pain (OR 2.8, 95% CI, 1.6-4.9), EPDS score >/=12 (OR 5.8, 95% CI 3.5-9.7), high degree of worry about relationships (OR 3.1, 95% CI 1.3-7.7), infant sleeping problems (OR 6.9, 95% CI, 3.0-16.2), negative birth experience with vacuum delivery (OR 3.4, 95% CI, 1.0-11.0), and negative experience with c-section (OR 3.5, 95% CI, 1.2-10.3) were associated with poor SRH. Multiparas 2 months: unemployment in year prior to pregnancy (OR 2.1, 95% CI, 1.2-3.7), tiredness (OR 1.7, 95% CI, 1.0-3.2), headache (OR 2.3, 95% CI, 1.5-3.7), neck and shoulder pain (OR 2.0, 95% CI, 1.3-3.1), EPDS score ≥12 (OR 4.2, 95% CI, 2.6-6.8), no support or not satisfied with support from someone close (OR 2.1, 95% CI ,1.4-3.3), poor baby's health (OR 5.4, 95% CI, 2.1-14.4), negative experience with breastfeeding (OR 4.4, 95% CI, 1.8-11.2) associated with poor SRH. Multiparas 1 year: unemployment in year prior to pregnancy (OR 1.6, 95% CI, 1.0-2.8), history of unemployment (OR 1.7, 95% CI, 1.1-2.6), tiredness (OR 2.6, 95% CI, 1.6-4.3), headache (OR 1.8, 95% CI, 1.2-2.6), neck and shoulder pain (OR 2.6, 95% CI, 1.8-3.9), abdominal pain (OR 2.0, 95% CI, 1.3-3.2), EPDS score ≥12 (OR 4.8, 95% CI 3.2-7.3), no support or unsatisfied with support from partner (OR 1.6, CI, 1.1-2.3), no support or not satisfied with support from someone close (OR 1.6, 95% CI ,1.1-2.4), poor baby's health (OR 2.9, 95% CI, 1.5-5.7), positive experience with elective cesarean section (OR 2.0, 95% CI, 1.0-3.9) associated with fair/poor SRH.
Schytt, Waldenström & Olsson[111] (2009)* Sweden	*SRH Measure:* *Qualitative study examining how women interpret 5-item SRH question; (very good, good, neither good nor bad, bad, very bad) *SRH Assessment:* Approximately 1 year postpartum

26 women (of 54 eligible) recruited from two child health clinics in Sweden at 1 year from childbirth. All women who attended the routine 1-year well child visit in April-June 2005 were assessed for eligibility and invited to participate.	*SRH Prevalence:* N/A *SRH-Related Aim(s):* How women interpret the question "How would you summarize your state of health at present" and what the question captures when asked 1 year after childbirth *SRH-Related Results:* SRH captured the following: family function and well-being; relationship with partner; combining motherhood and professional work; energy; physical and emotional problems impacting daily life; stressful life events; chronic disease (that has ongoing symptoms); body image; physical exercise and happiness. Less than good SRH represented a high burden of health problems.
Semasaka et al.[112] (2016) Rawanda 921 women from 48 villages in Northern Province and Kigali randomly sampled from women who gave birth within 13 months of data collection which occurred July-August 2014	*SRH Measure:* 5-item, dichotomized for part of analysis "good"(good/very good) and "poor"(neither good nor poor/poor/very poor) *SRH Assessment:* At time of interview and retrospectively for 1 day, 1 week, 1 month postpartum *SRH Prevalence:* 32.2% 1 day, 16.8% 1 week and 11.6% at 1 month *SRH-Related Aim(s):* To determine prevalence of health problems during pregnancy, birth and postpartum and to determine SRH and its determinants at 1 day, 1 week, 1 month postpartum. *SRH-Related Results:* At 1day postpartum, cesarean section (OR 3.20, 95% CI, 2.07-4.96); hypertension during pregnancy and delivery (OR 2.38, 95% CI, 1.22-4.62); anemia during pregnancy (OR 1.59, 95% CI 1.10-2.31); being unmarried, single, widowed or separated (OR 1.60, 95% CI, 1.02-2.51); lack of health insurance (OR 1.59, 95% CI, 1.11-2.28); and significant blood loss after delivery (OR 2.04 95% CI, 1.24-3.35) were associated with poor SRH. At 1 week postpartum, caesarean section (OR 1.95, 95% CI, 1.08–5.53); severe bleeding during pregnancy and labor (OR 3.60, 95% CI, 1.56–8.31); hypertension during pregnancy and delivery (OR 2.21, 95% CI 1.06–4.60); significant postpartum hemorrhage (OR 2.01, 95% CI ,1.12–3.58), woman's age less than 25 years (OR 1.71, 95% CI 1.05–2.80), and discharge time more than seven days postpartum (OR 2.81, 95% CI, 1.18–6.66) were associated with poor SRH. At 1 month: age <25 years (OR 2.71, 95% CI, 1.30-5.62); anemia during pregnancy (OR, 2.37, 95% CI,1.25-4.49); infection during pregnancy (OR 6.94, 95% CI, 2.14-22.53); severe bleeding during pregnancy and labor (OR 2.96, 95% CI, 1.09-8.02); and non-breastfeeding status (OR 9.54, 95% CI, 1.50-60.39) were associated with poor SRH. Being discharged at 3 days (reference <3) was associated with decreased odds of poor SRH (OR 0.49, 95% CI, 0.24-0.99)

Surkan et al.[113] (2009) Brazil 596 mothers of children 6-24 months old randomly sampled from nine low-income neighborhoods in Teresina, Piaui, Brazil.	*SRH Measure:* 4-item; dichotomized to (excellent/good) *and (*fair/poor) *SRH Assessment:* 6-24 months postpartum *SRH Prevalence:* Fair/poor 47% *SRH-Related Aim(s):* Determine the relationship between informal social support and networks to self-rated health among low-income women *SRH-Related Results:* Women with poor partner relationships (OR 1.7, 95% CI, 1.1-2.7); no material support for food or money (OR 1.6, 95% CI ,95% 1.2-2.0); no support to resolve a conflict (OR 1.5, 95% CI 1.1-2.1); and with lowest scores on social support index measure (OR 1.5, CI, 95% 1.0-2.1) had increased likelihood of reporting poor/fair health.
Sword, Watt & Krueger[114] (2006) Canada 1250 women who gave birth at five hospitals across Ontario (first 250 eligible and consenting women from each site) October 2001-August 2002	*SRH Measure:* 5-item Dichotomized excellent/very good and good/fair/poor *SRH Assessment:* 4 weeks after discharge *SRH Prevalence:* Good/fair/poor immigrant 54.6%, 37.4%. (43% total study population who answered) *SRH-Related Aim(s):* To describe immigrant women's postpartum health service needs, access to services and service use during first 4 weeks following hospital discharge. *SRH-Related Results:* Immigrant women had higher unadjusted odds of good/fair/poor SRH (OR 2.01, 95% CI, 1.50-2.69)
Tunstall, Pickett and Johnsen[115] (2010) United Kingdom 18,197 mothers (of 18,819 eligible) of infants born in the UK in 2000-2002 included in the first wave of a national longitudinal social, economic and health survey	*SRH Measure:* 4-item, dichotomized to (Excellent/good) *and "lower"*(fair/poor) *SRH Assessment:* 8-12 months postpartum *SRH Prevalence:* Not reported *SRH-Related Aim(s):* *SRH-Related Results:* Moving during the first year postpartum was independently associated with fair or poor health (OR 1.23 95% CI, 1.08-1.40)

Wabiri et al.[116] (2013) South Africa Women who in national population-based health survey conducted from May 2008-March 2008 reported having been pregnant in the last two years (n = 1113) or delivered a child in the past two years (n = 1304)	*SRH Measure:* 4-item, dichotomized to (excellent/good) *and* (fair/poor) *SRH Assessment:* 0-24 months postpartum *SRH Prevalence:* Fair/poor 12.5% *SRH-Related Aim(s):* To examine the influence of SES on self-assessed maternal health status. *SRH-Related Results:* Statistically significant difference ($p < 0.05$) between wealthiest and poorest by socio-economic quartiles
Webb[117] (2018) Australia 5107 mothers from cohort of the Longitudinal Study of Australian Children (LSAC), a nationally representative sample of mother-infant dyads	*SRH Measure:* 5-item; poor to excellent *SRH Assessment:* Approximately 9 months postpartum (and at other points >24 months postpartum not included here) *SRH Prevalence:* Not reported *SRH Related Aim(s):* To determine if women who are employed part time have better health than mothers who are not employed. *Significant SRH Related Results:* At time of initial assessment (the SRH assessment in timeframe of interest) poor SRH was associated with increased odds of mothers reporting that their infant had a feeding problem (OR 1.39, 95% CI, 1.25-1.55). Maternal poor SRH was predictive of shorter duration of breastfeeding ($\beta = -0.12$, $p < 0.001$).

Maternal Postpartum SRH

While limited in number, these studies provide important insight into the patterns and determinants of SRH among mothers in the postpartum as well as an improved understanding of what SRH captures when it is used as a health measure in this particular population.

Epidemiology of Self-Reported Health in Postpartum Mothers

In general, a majority of postpartum mothers report an SRH that is considered positive. The prevalence of poor/low SRH among postpartum mothers in the studies reviewed ranged from 3.7%, reported at one month by mothers in Australia,[106] to 40%, reported at 0-6 weeks by new mothers in Turkey[96]. By way of comparison, the global prevalence of poor SRH in a World Health Organization sample of 219,713 men and women 25 years old or older from 69 countries was 9.8%.[118] In this sample, which did not include individuals from the US, poor SRH ranged from 2.5% (Australia, the United Arab Emirates and Uruguay) to 48.9% (Swaziland), highlighting the fact that some of the variation of poor SRH reported in the postpartum period in the studies included in the review likely reflects the underlying variation in SRH of the populations from which the samples were drawn.

At a population-level, SRH appears to fluctuate during the perinatal period. Maternal SRH is generally affected negatively by advancing pregnancy and positively by childbirth. At the onset of pregnancy, the SRH of women is similar to, or better than, comparative samples of reproductive-aged women.[101] During the course of pregnancy, however, there are increasing limitations in physical function, greater restrictions in vitality, and higher prevalence of depressive symptoms that appear to be reflected in worsening SRH as pregnancy progresses.[101,108] The proportion of women who rated their physical health as poor increased from mid to late pregnancy, from 20.4% to 36.9%.[108] Somewhat surprisingly, given the

demands of labor and newborn care, childbirth and the immediate postpartum seem to have a positive effect on SRH. In the first few months postpartum, SRH appears to improve, reaching levels similar to or even better than baseline SRH.[101,108] This effect may be temporary. Several of the Swedish studies that followed women beyond the first 2-3 postpartum months suggest worsening SRH over the first year of motherhood.[108–110] By 1 year postpartum the proportion of women reporting poor physical SRH reached 33.7% from a low of 19.9% at 2 months postpartum.[108] On average; however, postpartum SRH may be better than that of the general population of women of reproductive age.[109]

Predictors of Maternal Self-Reported Health in the Postpartum

Socio-Economic Status (SES). The relationship between demographic factors and maternal SRH was the primary focus of a third (33%) of the studies reviewed.[98,99,101,105,107,114,115] Unemployment, financial worries or a poor financial situation are consistently associated with poor SRH in the postpartum period. [101,106,108,110,116,119] Other measures of less advantaged SES, such as being an unskilled laborer[107]; having less that a college education[108]; having an unemployed or economically inactive partner[107]; residing in non-private housing[106] or housing with no indoor plumbing[105]; or living in a neighborhood of medium or high deprivation[107] are also associated with poor SRH among new mothers in the postpartum. Migrant status or foreign national origin[98,99,114] or being of non-White race/ethnicity[107] was associated with poor maternal SRH is several studies. The contribution of sociodemographic factors to SRH appears to decrease significantly, however, when physical, emotional and health behavior variables are included in models.[109]

The homogeneity of the study population and the population from which the study sample was drawn must also be taken into account when interpreting the impact of socio-

economic and demographic factors on SRH. Several of the Swedish studies,[108–110] for example, excluded non-Swedish speakers thus creating a homogenizing effect that may mask the impact of sociodemographic determinants on SRH. Additionally, Sweden has what is considered one of the most generous parental leave policies and provides free health care to its citizens – these policies can also lead to an increased homogeneity in the study population that may limit the ability to identify SES determinants of SRH from these studies. A similar effect may have occurred in a US study that found that sociodemographic variables were not strongly associated with maternal SRH.[119] This study was conducted on a relatively homogeneously disadvantaged group of women, thus making it less likely that SES variables would emerge as significant predictors of SRH.

Employment. While being employed was associated with better SRH over being unemployed,[97,107,110] this relationship is informative about impact of SES on maternal SRH and not on the impact of return to work on maternal SRH. This relationship has not been well explored in the SRH literature. A longer maternity leave was associated with better SRH in the one study that included maternity leave as a possible predictive factor of maternal SRH[100].

Physical and Mental Health Concerns. Less than 'good' SRH in the postpartum represents a high burden of health problems, although not necessarily ones specific to the recovery childbirth.[96,109–111] Mental health factors such as stress[108]s and depressive symptoms[110] are also associated with poor SRH. In an evaluation of the comparative contribution of predictive variables (sociodemographic, physical, emotional, infant-related, and pregnancy and birth-related), the physical and emotional blocks were the main contributors to explained variance of SRH in the postpartum period.[110] The association between physical health and SRH was strongest and most consistent with symptoms that affect general physical functioning and

well-being, such as headache, tiredness and back pain - more so than with physical symptoms related directly to pregnancy or childbirth such as perineal or breast pain.[109,110] Of the physical symptoms, tiredness/fatigue is most consistently and strongly associated with poor maternal SRH.[96,109,110] These results are in line with those from other studies of maternal postpartum physical concerns in which tiredness/fatigue is the most commonly reported postpartum health concern.[31,32,120–122] Tiredness appears to persist[109,110,120–122] or worsen[121] through the first postpartum year and is a health concern that appears to be more common among postpartum women than in the general population of women of reproductive age.[109]

Social Support. A lack of social support or disappointment with the amount/type of support received emerges as a significant, independent predictor of poor maternal SRH in multiple studies.[101,105,106,108,110,113] In a longitudinal exploration of the relationship between social support and SRH prior to pregnancy, during pregnancy and following pregnancy, social support did not become a significant predictor of SRH until the postpartum period,[101] further underscoring the particular importance of social support in this time period.

C-Section and Other Obstetric Factors. Cesarean delivery [101,104,108,110,112] and physical concerns related to c-section such as pain or itching at the incisional site[96] are associated with poor maternal SRH, even up to a year postpartum. This is consistent with a fairly robust body of research on the health impacts of route of delivery that has found that unplanned cesarean section and forceps-assisted birth are associated with increased risk of psychological and physical health concerns when compared with spontaneous, unassisted vaginal delivery.[123–126] Given that global c-section rates have doubled in the last 15 years, and that in some countries (including the United States) at least one out of three babies is born via c-section,[127] the potential impact of unplanned operative delivery on both short and long-term maternal health is an important concern.

Infection or anemia during pregnancy, severe bleeding or hypertension during pregnancy or labor and significant postpartum hemorrhage[112] and pregnancy-induced hypertension[104] are other obstetric factors associated with poor maternal SRH in the postpartum. Women who experienced preeclampsia were more likely to report a decline in self-rated health from pregnancy to postpartum compared with unaffected women,[104] indicating that the presence of obstetric complications may negatively impact the trajectory of SRH in the postpartum period.

Breastfeeding and Other Infant-Related Factors. Maternal SRH and breastfeeding seem to have a bi-directional relationship. A mixed or negative experience with breastfeeding is an independent risk factor for poor SRH in both primiparous and multiparous women .[110] Relatedly, nipple pain and nipple fissures related to breastfeeding are associated with poor SRH.[96] Maternal SRH, in turn, may impact the success of breastfeeding. Maternal SRH is independently associated with breastfeeding initiation and continuation and may also predict premature discontinuation of breastfeeding.[102] Infant sleeping problems,[103,110] infant prematurity and poor infant health[110] are other infant-related factors associated with poor maternal postpartum SRH.

Implications for Present Study

This literature review suggests that SRH is a useful population-level measure of maternal health status in the postpartum, providing information about both the distribution and determinants of health of new mothers. Existing literature supports the use of SRH in the postpartum population not necessarily as measure of recovery from childbirth, but as a barometer of general maternal health and well-being in this time period. A qualitative examination in a sample of 26 women to determine what is captured by SRH in the first postpartum year provides support for this assessment.[111] When women were asked to describe a “state of health”, a sample

of 26 women in the postpartum period described two principal components: physical and emotional health which, in turn, were impacted by a variety of factors, most of which were not related to recovery from childbirth. The answer to the question on SRH "captured a woman's total life situation, such as family functioning and wellbeing, relationship with partner, combining motherhood and professional work, energy, physical symptoms and emotional problems affecting daily life, stressful life events, chronic disease with ongoing symptoms, body image, physical exercise and happiness".[111(p711)] In addition to allowing an assessment of the health status of the general population of postpartum mothers, the use of SRH may allow identification of sub-populations of those mothers at risk for compromised health in the postpartum period that may not be identified by current postpartum risk assessments that focus on obstetric risk factors or clinically evident disease/illness.

Variations in the time intervals at which SRH is assessed and variations in how the SRH variable is treated in the different studies limits the comparability across studies. Despite these limitations, this literature suggests that maternal SRH in the postpartum is positive and better than SRH in pregnancy (particularly the last stages of pregnancy and maybe better, on average, than that of women of reproductive age who are not postpartum. A similar limitation of the current body of literature on maternal postpartum SRH is that the relationships between postpartum SRH and many predictive variables were only explored in a single study, making it difficult to assess for consistency of these factors as determinants of postpartum maternal SRH. However, tiredness, breastfeeding difficulties, social support, and disadvantaged SES emerge as predictors of poor SRH in multiple studies. The most notable limitations of the current body of research on maternal SRH, from a US public health perspective, is that the most comprehensive data come from studies that were all conducted in Sweden. While the findings from the few

studies conducted on samples from the US suggest similar patterns and determinants of SRH as those identified in this review, prior to this study there are no US population studies of maternal SRH in the postpartum period. The results of this study, therefore, help fill the gap on information regarding SRH of US women in the postpartum and, by extension, the gap in knowledge regarding maternal health in the year following childbirth.

Chapter 4: Methods

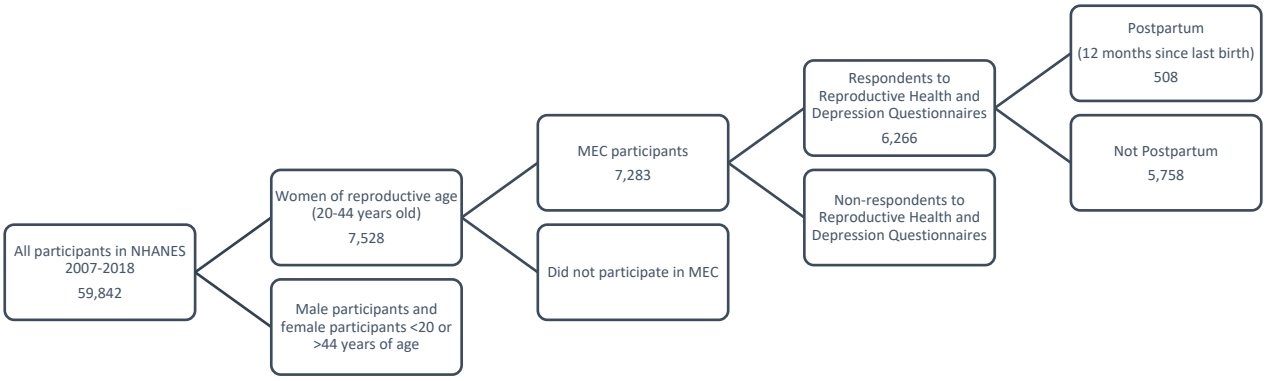
Data Source and Population

Data were drawn from National Health and Nutrition Examination Survey (NHANES), a cross-sectional survey of a representative sample of the noninstitutionalized U.S. population that has been conducted continuously since 1999 in 2-year cycles. In 2007, NHANES began assessing the number of months (up to 24 months) since female respondents 20-44 years of age most recently had a birth. This allows for identification of a postpartum population.

National Health and Nutrition Examination Survey data collection is conducted in two parts. The first is achieved via health questionnaires that are administered in participants' homes. A subset of those who participate in the household interviews then also participate in a medical examination consisting of medical, dental and physiological measurements including laboratory tests that are conducted in mobile examination centers (MEC). The MEC component of NHANES also includes the administration of questionnaires of a more sensitive nature utilizing touch-sensitive computer screens that allow respondents to enter their own responses to the questions. These are referred to as computer assisted personal interview (CAPI) or audio computer assisted personal self-interview (ACASI) questionnaires based on whether or not, respectively, an in-person interviewer is administering the questions. This study used data from respondents to the in-house interview and the MEC-administered Depression Screen Questionnaire (DPQ) and Reproductive Health Questionnaire (RHQ) in the last six waves of NHANES (2007-2008, 2009-2010, 2011-2012, 2013-2014, 2015-2016, 2017-2018). The University of Maryland College Park Institutional Review Board determined this study to be except from IRB review. The letter of determination of exempt status is included as Appendix 1.

A study sample of 6,266 women of reproductive ages that includes 508 postpartum women was created. Derivation of the study sample is described in Figure 2.

Figure 2. Derivation of Study Sample



Measures

Dependent Variable

Self-reported health (SRH) is the primary outcome variable for all the analyses. In NHANES, self-reported health is assessed in the Hospital Utilization and Access to Care Questionnaire (HUQ) that is administered during the household interview. The response to the HUQ question - "Would you say your health in general is excellent, very good, good, fair, or poor?" was used to create the SRH variable. The most common treatment of SRH in the literature is to dichotomize it into a negative and positive level and to model on the negative level. In order to maximize comparability with other studies of postpartum SRH,[96,98,99,102,105–107,109,110,112–116] a dichotomous SRH variable was created. Responses were coded as either

"good" (excellent, very good, good) or "poor" (fair, poor) and results were modelled on poor SRH.

Independent Variables

Postpartum status. Women who replied that they had a birth 1 to 12 months prior to the interview (hereafter referred to as the "index" birth) in response to the question, "How many months ago did you have your baby?", were considered to be postpartum for this study. Responses of women who had a birth less than1 month before the interview were coded by NHANES as equal to being 1 month from birth.

Age. Despite confining the analytic sample to women of reproductive age, the possibility of age-related confounding of the relationship between SRH and postpartum status remains. Age is, therefore, included in the models as a continuous variable.

Socioeconomic Variables. Race/ethnicity is coded as non-Hispanic white, non-Hispanic black, Hispanic (of any race our country of origin), and other (which includes those who identified as being of non-Hispanic Asian, multiple races or any other race/ethnicity).

Educational status. Educational status for adults 20 and older was ascertained by NHANES by asking participants to indicate which educational category reflected the highest completed level of education at the time of the survey (less than 9^{th} grade; 9-11^{th} grade (including 12^{th} grade with no diploma); high school graduate, GED or equivalent; some college or AA degree; college graduate or above). The first two NHANES categories were collapsed into one and coded as less than a high school education. The other categories were coded the same way they are coded in NHANES (high school diploma or equivalent, some college education, and college graduate).

Family income-to-poverty ratio (FIPR). Family income-to-poverty ratio (FIPR) was used to assess the impact of economic status on SRH. The five NHANES FIPR categories were collapsed to four categories by combining 200-299% and 300-399% into one category (<100%, 100-199, 200-399% and ≥400%).

Marital status. Marital status was coded to include all those who reported being married or living with a partner into a married/partnered category, and those who reported being divorced, widowed, separated or never married into a not married/unpartnered category.

Employment. An employment variable was created using the response to the question in the Occupation Questionnaire that assesses the type of work done in the week preceding the survey ("Which of the following were you doing last week: working at a job or business; with a job or business but not at work; looking for work; or not working at a job or business?"). Those who reported being with a job or business in the previous week, or who reported being with a job or business but not at work in the previous week, were categorized as employed, while those who reported that in the previous week they were either looking for a job or were not working with a job or business were categorized as not employed.

Acculturation. An acculturation variable was created for this study based on methods described by Kandula et al.[73] and adopted by others for use in studies using NHANES data.[128,129] The acculturation variable in this study reflects respondents' nativity ("In what country where you born?"), language spoken at home ("What language(s) do you usually speak at home?", and duration of US residence ("In what month and year did you come to the United States to stay?"). Participants received one point for each of the following: 1) having been born in the US; 2) having resided in the US 20 years or more; or 3) either speaking only English at home or speaking English equally or more than another language at home. The US-born participants

were not asked about length of time in the US. I assumed length of time residing in the US for US-born participants to be equal to their age, and all US-born participants received one point for living in the US for 20 years or more. This scoring system led to a four-point score with each participant being assigned an acculturation score of 0-3. Those who received a score of 0 or 1 were grouped into a low-acculturation category and those who received a score of 2 or 3 were placed into a high-acculturation category.

General Health Variables

Tiredness. The response to the question "Over the last 2 weeks, how often have you been bothered by feeling tired or having little energy?" from the Mental Health - Depression Screen Questionnaire was used to build a variable to represent the concept of tiredness/exhaustion. Individuals reporting no days of feeling tired were categorized as not tired/exhausted and those who reported feeling tired or having little energy any days in the previous two weeks were categorized as tired/exhausted.

Sleep. Sleep variables were created using the response to the question "How much sleep do you usually get at night on weekdays or workdays?" The National Sleep Foundation recommends that adults 18 years of age or older should sleep 7-10 hours per day.[130] Since both insufficient and excessive sleep duration have been associated with poor health outcomes, one of the variables for sleep includes three distinct sleep categories (<7 hours, 7-10 hours, >10 hours). This three-level variable was used on the analyses that included all women of reproductive age in the analytic sample. Because of the much smaller size of the postpartum sample, a second, dichotomous sleep variable was used for analyses of the postpartum population. This sleep variable classified sleep as either normal (7-10 hours of sleep) and not normal (<7 or >10 hours of sleep).

Depression. The PHQ-9 is a commonly used tool in clinical practice to screen for depression in adults that has been validated in perinatal populations.[131] The screen assesses for frequency of 9 different symptoms of depression in the 2 preceding weeks. All 9 items have the same symptom frequency response categories ("not at all," "several days," "more than half the days," and "nearly every day"). The Depression Screen Questionnaire (DPQ) used in NHANES includes the nine depression-screening items from the Patient Health Questionnaire (PHQ-9). The answers to these nine items, can, therefore, be used to create a composite depression screen score. Following established methods for scoring the PHQ-9 (Brody, Pratt & Hughes, 2018) the response categories of "not at all," "several days," "more than half the days," and "nearly every day" were given a score of 0, 1, 2 or 3 respectively, and the scores added to create a composite score ranging from 0-27. Depression in this study was defined using a composite score of 10 or higher, which is a well-validated cut-off point for moderate to severe depression.[131] Those who had scores of 10 or higher were classified as depressed, while those with scores <10 were classified as not depressed.

Body-Mass Index/Obesity. Participants in NHANES had their height and weight measured and these measurements were used to calculate their body-mass index (BMI) using the formula BMI = kg/m^2, where kg is a person's weight in kilograms and m^2 is their height in meters squared. The presence of obesity was characterized in this study using World Health Organization's criteria, which defines obesity as a BMI of 30 or greater and a BMI of 40 as extreme or severe obesity. A variable with three BMI categories (<30, 30-40, and >40) was created for use in the first part of this study. For the second part of this study (where the analytic sample is smaller), BMI was categorized as obese (≥30) or not obese (<30).

Perinatal Variables

***Pregnancy*.** Pregnancy was included as a dichotomous variable. Women with a positive pregnancy test and those who reported being pregnant at the time of medical exam were considered to be pregnant. Those who were not pregnant at the time of medical exam, or for whom pregnancy status could not be determined, were considered not to be pregnant.

Parity. The relationship between postpartum status and SRH may be confounded by the fact that the health of women who have had a live birth may be of different underlying health from those who have not.[132] To account for this effect when determining whether postpartum status is independently related to SRH, a dichotomous parity variable (nulliparous versus parous) was created. Because NHANES does not ask about parity directly, the parity variables were created using multiple variables that assessed pregnancy, deliveries and births. All women of reproductive age who responded in the affirmative to "How many of your deliveries resulted in a live birth?" were classified as parous. Those who responded that they have had no live births, those who have never been pregnant (responded "no" to question "Have you ever been pregnant?"), those who are pregnant for first time at the time of survey, women who have been pregnant but do not report a delivery (women who answer "yes" to question about ever being pregnant and report that they have been pregnant one time in response to "How many times have you been pregnant?" but who do not report a delivery), and those who did not report a live birth but do report a vaginal or c-section delivery were all classified as non-parous.

By definition, all the women in the postpartum sample are parous, therefore, a second parity variable was needed in order to explore whether parity predicts poor SRH in the

postpartum. For this second parity variable (primipara vs. multipara), all women who are within 12 months from last live birth and who reported having one delivery that resulted in a live birth were classified as primiparas, while all the postpartum women who reported that 2 or more live birth were classified as multiparas.

Breastfeeding. A breastfeeding variable was created using the response to the question in the RHQ that asked women whether they were currently breastfeeding ("Are you now breast feeding a child"?). All postpartum women were classified as either breastfeeding if they replied "yes" or not breastfeeding if they replied "no".

C-Section. Postpartum women who reported one or more c-sections in answer to the question "How many cesarean deliveries have you had?", were categorized as having a history of c-section, while those who replied "0" were categorized as not having a history of c-section. Of note is that except for primiparas, it is not possible to determine whether the index birth occurred via c-section.

Analytic Method

Analysis was conducted utilizing R specialized procedures for multiple imputation and for the analysis of complex survey data. Each individual selected to participate in NHANES receives a base weight that accounts for complex survey design, including oversampling, survey non-response, and post-stratification, so that estimates reflect the US population distribution and can be considered to be nationally representative. NHANES provides separate interview weight, the MEC exam weights, and several subsample weights. Use of the correct sample weight for NHANES analyses depends on the variables being used. The Depression and Reproductive Health questionnaires were administered during the MEC, therefore the MEC exam weights were used in all of the analyses. Because multiple, two-year cycles were used in this study, a

weight was calculated that rescaled the weights of the six waves so that the sum of the weights matched the survey population at the midpoint of that period.

I assessed patterns of missing responses that could distort analysis. The results of this analysis are presented in Table 3. I then used the Multivariate Imputation by Chained Equations (MICE) procedure in R to impute missing values for family income to poverty ratio (FIPR). The MICE package allows the creation of a number of imputed datasets that to replace missing values with plausible values to estimate more realistic regression coefficients that are not affected by missing values. Race/ethnicity, education and age were used to predict FIPR in the imputation. The primary analyses were then conducted as described in detail below. Throughout the study, a *p*-value of 0.05 was used as the cut-off to determine statistical significance.

I estimated the prevalence of poor self-reported health and sociodemographic and health characteristics for US women of reproductive age (20-44 years of age) as a total population and stratified by postpartum status. As appropriate, t-tests or χ^2 tests for homogeneity were used to test for differences between groups. Results are presented in Table 4. Next, I conducted bivariate regression analyses to determine the unadjusted associations between self-reported health and the primary independent variable (postpartum status) and each of the control variables and covariates. To test the hypotheses that postpartum status has a protective effect on SRH, and that this effect is moderated by pregnancy, I fit a series of nested regression models that included an interaction term (postpartum status * pregnancy status). Results are presented in Table 6.. I then fit fully adjusted models for pregnant and nonpregnant populations to further characterize

the effect of pregnancy on the relationship between SRH and postpartum status in this population. The results of these are presented in Table 7.

In order to determine whether pregnancy, parity, cigarette smoking, depression, sleep duration, fatigue, obesity, history of c-section or breastfeeding status predict postpartum SRH in US population, I first conducted bivariate regression analyses to determine the unadjusted associations between self-reported health and each of these potential predictors of postpartum SRH. I then used multivariate logistic regression to determine whether, when controlling for sociodemographic factors, any of the variables of interest were independent predictors of SRH. As before, co-variables of interest were grouped into blocks and then used to fit a series of nested regression models. I then fit a complete model including all the variable blocks. The results are presented in Table 8..

Post Hoc Analyses

In order to better characterize the relationship between postpartum SRH and breastfeeding and obesity, I fit separate nested models in which these significant predictors were each treated as the primary independent variable. These results are presented in Table 9 and Table 10.

Chapter 4: Results

Data Missingness

Less than 1% (0.1%) of the analytic sample of women 20-44 years of age was missing data on self-rated health. With the exception of family income to poverty ratio (FIPR), all study variables were missing <3% of responses, with most missing <1%. Results from the analysis of missing data is presented in Table 3.

Table 3. Data missingness for analytic Sample of US Women of Reproductive Age (20-44 years), NHANES 2007-2018

Variable	Missing n (%)
Self-Rated Health	5 (0.1)
Age	0 (0.0)
Race/Ethnicity	0 (0.0)
Acculturation	102 (1.6)
Education	2 (0.0)
Family Income to Poverty Ratio (FIPR)	471 (7.5)
Marital status	2 (0.0)
Employment status	6 (0.1)
Insurance status	8 (0.1)
Parity	22 (0.4)
Depression	22 (0.4)
Tiredness	11 (0.2)
Sleep	10 (0.2)
Obesity	35 (0.6)
Breastfeeding	0 (0.0)
C-Section	0 (0.0)
Smoking	2 (0.0)

Descriptive Statistics

Table 4 includes a description of the study population of US women of reproductive age as a whole and by postpartum status in terms of self-reported health, sociodemographic and health factors. When compared to a sample of women in the same age range but who had not given birth in the previous year, postpartum women were younger (p <0.01), less likely to report family incomes greater than 200% or 400% (p <0.01), less likely to have a college education or degree (p = 0.01), and less likely to be employed (p <0.01). A larger percentage of the postpartum women than of the comparison sample of reproductive aged women reported being married or partnered (p <0.01) and having inadequate sleep (p <0.01). A lower percentage of postpartum women had a depression score of >10 (p = 0.02). There was no statistical difference between the two groups of women in terms of reported race/ethnicity, acculturation, insurance status, tiredness, pregnancy status, smoking status or obesity.

Table 4. Self-Reported Health, Demographic and Health Characteristics of US Women of Reproductive Age (20-44 years), NHANES 2007-2018

	All (n=6,266)	Not Postpartum (n=5,758)	Postpartum (n= 508)	*p*-value
Weighted population	**45,880,010**	**42,343,303**	**3,536,707**	
Percent of weighted	**100%**	**92.3%**	**7.7%**	
SRH 2-level				**0.02***
Good	85.2	84.9	89.5	
Poor	14.8	15.1	10.6	
				<0.01*
Mean Age (SE)	31.9 (0.17)	32.2 (0.18)	28.5 (0.30)	
Race/Ethnicity (%)				0.16
Non-Hispanic White	58.9	59.1	56.1	
Non-Hispanic Black	13.4	13.4	14.0	
Hispanic	18.5	18.2	21.9	
Other	9.2	9.3	8.0	
Acculturation (%)				0.73
Higher acculturation	85.5	85.6	84.9	
Lower acculturation	14.5	14.4	15.0	
Education Status (%)				**0.01***
Less than high school	13.2	12.8	16.9	
High school	18.9	18.5	24.0	
Some college	36.4	36.7	32.6	
College	31.6	32.0	26.5	
Family IPR (%)				**<0.01***
<100%	20.4	19.6	29.7	
100%-199% FPT	22.3	22.1	24.4	
200% - 399% FPT	28.7	28.8	27.6	
≥400 FPT	28.6	29.4	18.3	
Marital Status (%)				**<0.01***
Married/Partnered	59.5	57.9	78.3	
Not Married/Partnered	40.5	42.1	21.3	
Employment Status (%)				**<0.01***
Employed	70.1	72.2	45.4	
Not Employed	29.9	27.8	54.6	
Insurance Status (%)				0.15
Insured	78.5	78.2	81.3	
Not Insured	21.5	21.8	18.7	
Pregnancy (%)				0.34
Not Pregnant	95.1	95.2	94.2	
Pregnant	4.8	4.8	5.8	

Parity (%)				**<0.01***
Never had live birth	37.0	40.1	0.0	
1 or more live births	63.0	59.9	100.0	
Depression (%)				**0.02***
No	89.5	89.1	93.6	
Yes	10.5	10.9	6.4	
Tired/Fatigue (%)				0.28
No	38.7	38.9	36.0	
Yes	61.3	61.1	64.0	
Sleep (%)				**<0.01***
7-10 hours	68.8	70.1	53.8	
<7 hours	29.4	28.2	43.2	
>10 hours	1.8	1.7	3.0	
Obesity (%)				0.15
BMI <30	63.0	63.4	58.8	
BMI 30-40	27.1	26.7	31.7	
BMI >40	9.8	9.9	9.5	
Smoking (%)				0.54
Not current smoker	79.0	78.9	80.1	
Current smoker	21.0	21.1	19.9	

SE = standard error. *P<.05.

Aim 1

Aim 1 was to determine the patterns of self-reported health of US women of reproductive age. Table 5 shows the results of reports of SRH by each of the 5-SRH levels and then by the dichotomized SRH variable. A smaller proportion of postpartum women than not postpartum women reported poor SRH in the two-level SRH analysis (p = 0.02).

Table 5. 5-level and 2-level Distribution of SRH Responses: US Women of Reproductive Age (20-44 years), NHANES 2007-2018

	All (n=6,266)	**Not Postpartum (n=5,758)**	**Postpartum (n= 508)**	***p*-value**
Weighted population	**45,880,010**	**42,343,303**	**3,536,707**	
Percent of weighted	**100%**	**92.3%**	**7.7%**	
SRH 5-level				0.23
Excellent	16.5	16.2	20.4	
Very good	33.1	33.3	31.2	
Good	35.5	35.3	37.8	
Fair	12.8	13.1	9.8	
Poor	1.9	2.0	0.8	
SRH 2-level				
Good	85.2	84.9	89.4	**0.02***
Poor	14.8	15.1	10.6	

Aims 2 and 3

Aim 2 was to determine whether postpartum status is independently associated with self-reported health among US women of reproductive age and Aim 3 was to determine whether pregnancy moderates the relationship between postpartum status and self-reported health.

Bivariate and Moderation Analyses

Table 6 presents the result of the bivariate analyses that tested for associations between postpartum status and each of the covariates as well as the multivariate regression analysis conducted to test for a moderating effect of pregnancy on the relationship between postpartum status and SRH. In the bivariate analyses, all the study variables, with the exception of

pregnancy, were found to have significant associations with self-reported health in US women of reproductive age. The fully adjusted model shows that the interaction term for pregnancy and postpartum status, shows that the interaction term is significant (OR 4.11, 95% CI, 1.06-16.00).

Table 6. Postpartum Status and Odds of Poor Self-Reported Health (SRH) Among US Women of Reproductive Age (20-44 years), NHANES 2007-2018

	Unadjusted OR		Adjusted OR (Nested Model 1)		Adjusted OR (Nested Model 2)		Adjusted OR (Nested Model 3)		Adjusted OR (Full Model)		Adjusted OR (Full Model + Interaction)	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Postpartum Status												
Not postpartum	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Postpartum	**0.66***	(0.47-0.93)	**0.67***	(0.48-0.95)	**0.56***	(0.39-0.81)	**0.59***	(0.40-0.87)	**0.57***	(0.38-0.84)	**0.51***	(0.33-0.78)
Age	**1.03***	(1.01-1.04)	**1.02***	(1.01-1.04)	**1.04***	(1.03-1.05)	**1.00***	(0.99-1.02)	**1.03***	(1.01-1.04)	**1.03***	(1.01-1.04)
Race/Ethnicity												
Non-Hispanic White	Ref	Ref	Ref	Ref					Ref	Ref	Ref	Ref
Non-Hispanic Black	**1.93***	(1.55-2.38)	**1.95***	(1.57-2.43)					**1.40***	(1.11-1.76)	**1.39***	(1.10-1.75)
Hispanic	**3.05***	(2.49-3.73)	**3.00***	(2.43-3.70)					**2.25***	(1.77-2.86)	**2.24***	(1.76-2.86)
Other	1.18	(0.86-1.62)	1.19	(0.85-1.67)					1.35	(0.96-1.89)	1.34	(0.95-1.88)
Acculturation												
High	Ref	Ref	Ref	Ref					Ref	Ref	Ref	Ref
Low	**1.68***	(1.40-2.02)	1.02	(0.84-1.23)					1.22	(0.97-1.53)	1.23	(0.98-1.55)
Education Status												
Less than high school	Ref	Ref			Ref	Ref			Ref	Ref	Ref	Ref
High school	**0.46***	(0.38-0.55)			**0.60***	(0.49-0.73)			**0.65***	(0.51-0.81)	**0.65***	(0.51-0.81)
Some college	**0.31***	(0.25-0.39)			**0.46***	(0.36-0.58)			**0.50***	(0.39-0.65)	**0.50***	(0.39-0.65)
College	**0.10***	(0.08-0.13)			**0.19***	(0.14-0.26)			**0.27***	(0.20-0.38)	**0.27***	(0.20-0.38)
Family IPR												
<100%	Ref	Ref			Ref	Ref			Ref	Ref	Ref	Ref
100-199% FPT	**0.68***	(0.57-0.82)			0.84	(0.70-1.01)			0.90	(0.74-1.10)	0.90	(0.74-1.11)
200% - 399% FPT	**0.32***	(0.26-0.40)			**0.52***	(0.41-0.66)			**0.62***	(0.48-0.80)	**0.62***	(0.48-0.81)
≥400 FPT	**0.19***	(0.14-0.25)			**0.42***	(0.29-0.60)			**0.57***	(0.38-0.84)	**0.55***	(0.39-0.84)
Marital Status												
Married/Partnered	Ref	Ref			Ref	Ref			Ref	Ref	Ref	Ref
Not Married/Partnered	**1.23***	(1.06-1.41)			**1.23***	(1.04-1.45)			1.05	(0.87-1.28)	1.05	(0.87-1.27)
Employment Status												
Employed	Ref	Ref			Ref	Ref			Ref	Ref	Ref	Ref

Not Employed	**2.47***	(2.10-2.90)	**1.86***	(1.58-2.20)			**1.77***	(1.47-2.13)	**1.77***	(1.47-2.13)
Insurance Status										
Insured	Ref	Ref	Ref	Ref			Ref	Ref	Ref	Ref
Not Insured	**2.01***	(1.70-2.38)	1.13	(0.94-1.36)			1.03	(0.85-1.25)	1.03	(0.85-1.26)
Pregnancy										
Not Pregnant	Ref	Ref			Ref	Ref	Ref	Ref	Ref	Ref
Pregnant	0.73	(0.49-1.10)			0.74	(0.48-1.14)	0.73	(0.46-1.15)	0.61	(0.37-1.02)
Parity										
Never had live birth	Ref	Ref			Ref	Ref	Ref	Ref	Ref	Ref
1 or more live births	**1.82***	(1.54-2.14)			**1.58***	(1.28-1.95)	0.91	(0.72-1.15)	0.92	(0.73-1.16)
Smoking										
No	Ref	Ref			Ref	Ref	Ref	Ref	Ref	Ref
Yes	**2.10***	(1.73-2.54)			**1.55***	(1.25-1.92)	**1.43***	(1.14-1.81)	**1.43***	(1.13-1.80)
Depression										
No	Ref	Ref			Ref	Ref	Ref	Ref	Ref	Ref
Yes	**5.13***	(4.33-6.08)			**3.47***	(2.83-4.26)	**2.97***	(2.40-3.68)	**2.98***	(2.41-3.69)
Sleep										
<7 hours	**1.50***	(1.29-1.74)			1.08	(0.90-1.28)	1.01	(0.85-1.21)	1.01	(0.84-1.21)
7-10 hours	Ref	Ref			Ref	Ref	Ref	Ref	Ref	Ref
>10 hours	**2.34***	(1.48-3.70)			**1.75***	(1.07-2.86)	0.98	(0.55-1.76)	0.97	(0.55-1.68)
Tired/Fatigue										
No	Ref	Ref			Ref	Ref	Ref	Ref	Ref	Ref
Yes	**2.14***	(1.82-2.51)			**1.48***	(1.23-1.77)	**1.78***	(1.47-2.16)	**1.79***	(1.48-2.17)
Obesity										
BMI <30	Ref	Ref			Ref	Ref	Ref	Ref	Ref	Ref
BMI 30-40	**2.31***	(1.93-2.77)			**2.09***	(1.72-2.53)	**1.88***	(1.53-2.31)	**1.88***	(1.53-2.31)
BMI >40	**4.79***	(3.81-6.01)			**4.41***	(3.43-5.67)	**4.42***	(3.32-5.89)	**4.41***	(3.31-5.88)
Postpartum*pregnant									**4.11***	(1.06-16.00)

*p<0.05; SRH modeled on "Poor"

Stratified Multivariate Regression Analysis

Due to the significant interaction between pregnancy and postpartum in the full model (Table 6), I repeated the analysis stratified by pregnancy status. The results are presented in Table 7. In the stratified analysis, postpartum status is protective in terms of SRH for those women who are not pregnant (OR 0.52, 95% CI, 0.34-0.79). In the pregnant population, postpartum status was associated with higher odds of poor SRH (OR 2.34, 95% CI, 0.81-6.78), but this association did not achieve statistical significance ($p = 0.12$). While the association between postpartum status and SRH did not achieve statistical significance in the pregnant population, the size of the effect, the change in the direction of the effect and the non-overlapping confidence intervals suggest that postpartum status has an opposite effect on maternal SRH for those who are pregnant than for women who are not pregnant (detrimental rather than protective).

Table 7. Odds of Poor Self-Reported Health (SRH) Among US Women of Reproductive Age (20-44 years), NHANES 2007-2018. Stratified by Pregnancy Status

	Pregnant n=321		Not Pregnant n=5945	
	Odds Ratio	**95% CI**	**Odds Ratio**	**95% CI**
Postpartum Status				
Not postpartum	Ref	Ref	Ref	Ref
Postpartum	2.34	(0.81– 6.78)	**0.52***	(0.34-0.79)
Age (M ± SD)	1.02	(0.94-1.12)	**1.03***	(1.01-1.05)
Race/Ethnicity				
Non-Hispanic White	Ref	Ref	Ref	Ref
Non-Hispanic Black	0.64	(0.20-2.07)	**1.46***	(1.15-1.84)
Hispanic	2.03	(0.68-6.04)	**2.27***	(1.76-2.94)
Other	0.94	(0.24-3.61)	1.33	(0.91-1.93)
Acculturation				
High	Ref	Ref	Ref	Ref
Low	1.08	(0.29-4.05)	1.25	(0.99-1.58)
Education Status				
Less than high school	Ref	Ref	Ref	Ref
High school	0.27	(0.06-1.15)	**0.69***	(0.55-0.88)
Some college	**0.07***	(0.02-0.21)	**0.55***	(0.42-0.71)
College	0.21	(0.04-1.09)	**0.28***	(0.20-0.40)
Family IPR				
<100%	Ref	Ref	Ref	Ref
100-199% FPT	2.20	(0.71-6.86)	0.88	(0.71-1.08)
200% - 399% FPT	2.57	(0.57-11.50)	**0.58***	(0.45-0.76)
≥400 FPT	N/A	N/A	**0.58***	(0.39-0.85)
Marital Status (%)				
Married/Partnered	Ref	Ref	Ref	Ref
Not Married/Partnered	0.55	(0.15-1.96)	1.07	(0.88-1.30)
Employment Status				
Employed	Ref	Ref	Ref	Ref
Not Employed	1.61	(0.70-3.69)	**1.77***	(1.45-2.15)
Insurance Status				
Insured	Ref	Ref	Ref	Ref
Not Insured	1.44	(0.41-4.99)	1.03	(0.84-1.26)
Parity				
Never had live birth	Ref	Ref	Ref	Ref
1 or more live births	1.60	(0.55-4.68)	0.90	(0.71-1.14)
Smoking				
No	Ref	Ref	Ref	Ref
Yes	**9.00***	(2.57- 31.56)	**1.39***	(1.09-1.77)
Depression				
No	Ref	Ref	Ref	Ref

Yes	1.52	(0.28-8.24)	**2.99***	(2.40-3.73)
Sleep				
7-10 hours	Ref	Ref	Ref	Ref
<7 hours	1.66	(0.61-4.56)	1.00	(0.83-1.21)
>10 hours	0.31	(0.03-3.46)	0.99	(0.56-1.75)
Tired/Fatigue				
No	Ref	Ref	Ref	Ref
Yes	1.21	(0.42-3.49)	**1.80***	(1.47-2.19)
Obesity				
BMI <30	Ref	Ref	Ref	Ref
BMI 30-40	**3.95***	(1.40-11.15)	**1.83***	(1.48-2.26)
BMI >40	**5.50***	(1.09-27.82)	**4.34**	(3.24-5.81)

*p<0.05; SRH modeled on "Poor"

Aim 4

Aim 4 was to determine whether for postpartum mothers there is an independent relationship between SRH and common sociodemographic factors and selected health factors including breastfeeding, depressive symptoms, history of cesarean section, amount of sleep, tiredness, obesity, and smoking.

Multivariate Regression Analyses

Table 8 presents the result for both the bivariate and multivariate regression analyses examining the relationship between SRH and various sociodemographic and health factors among postpartum mothers. For women in the postpartum, having a high school education (OR 0.35, 95% CI, 0.13-0.95) and breastfeeding (OR 0.23, 95% CI 0.10-0.53) were each independently protective in terms of postpartum SRH. Being Hispanic (OR 3.51, 95% CI 1.20-10.27), tired (OR 2.40, 95% CI 1.08-5.57) or obese (OR 2.72, 95% CI, 1.35-5.56) were each associated with higher odds of maternal report of poor health.

Post-hoc Analyses

Table 9 and Table 10 present the results of the post hoc analyses conducted to further examine the relationship between breastfeeding and obesity and postpartum SRH. Breastfeeding is consistently associated with a protective effect on postpartum SRH, an effect that changes very little

in each model. In the fully adjusted model, postpartum women who reported breastfeeding had 77% lower odds of report poor SRH than those who were not breastfeeding (OR 0.23, 95% CI, 0.10-0.53). Obesity is associated with a strong and consistent negative effect on postpartum SRH. While the effect was somewhat smaller in the fully adjusted model, women who had a BMI greater than 30 had higher odds of reporting poor SRH than those who had a BMI less than 30 (OR 2.72, 95% CI, 1.33-5.56).

Table 8. Predictors of Poor Self-Reported Health (SRH) Among US Postpartum Women of Reproductive Age (20-44 years), NHANES 2007-2018

	Unadjusted OR		Adjusted OR (Nested Model 1)		Adjusted OR (Nested Model 2)		Adjusted OR (Nested Model 3)		Adjusted OR (Full Model)	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Age (M ± SD)	1.01	(0.96-1.07)	1.01	(0.96-1.07)	1.06	(1.00-1.12)	1.01	(0.94-1.07)	1.02	(0.94-1.11)
Race/Ethnicity										
Non-Hispanic White	Ref	Ref	Ref	Ref					Ref	Ref
Non-Hispanic Black	1.10	(0.42-2.88)	1.13	(0.42-3.07)					0.80	(0.28-2.33)
Hispanic	**4.59***	(2.08-10.12)	**4.52***	(1.68-12.12)					**3.51***	(1.20-10.27)
Other	2.91	(0.95-8.86)	3.03	(0.83-11.09)					3.57	(0.84-15.20)
Acculturation										
High	Ref	Ref	Ref	Ref					Ref	Ref
Low	**2.09***	(1.09-4.01)	0.88	(0.36-2.15)					0.92	(0.30-2.81)
Education Status										
Less than high school	Ref	Ref			Ref	Ref			Ref	Ref
High school	**0.33***	(0.16-0.69)			**0.35***	(0.16-0.74)			**0.35***	(0.13-0.95)
Some college	**0.31***	(0.14-0.65)			**0.31***	(0.15-0.64)			0.44	(0.19-1.04)
College	**0.15***	(0.05-0.40)			**0.17***	(0.05-0.61)			0.33	(0.09-1.29)
Family IPR										
<100%	Ref	Ref			Ref	Ref			Ref	Ref
100-199% FPT	1.08	(0.57-2.03)			1.40	(0.74-2.64)			1.66	(0.81-3.41)
200% - 399% FPT	0.40	(0.16-1.01)			0.56	(0.23-1.36)			0.61	(0.23-1.64)
≥400 FPT	0.18	(0.03-1.01)			0.31	(0.04-2.75)			0.50	(0.04-5.50)
Marital Status (%)										
Married/Partnered	Ref	Ref			Ref	Ref			Ref	Ref
Not Married/Partnered	1.12	(0.57-2.23)			0.85	(0.41-1.74)			0.65	(0.28-1.49)

Employment Status	Ref	Ref	Ref	Ref			Ref	Ref
Employed	**2.11***	(1.20-3.72)	1.68	(0.90-3.15)			1.59	(0.79-3.21)
Not Employed								
Insurance Status								
Insured	Ref	Ref	Ref	Ref			Ref	Ref
Not Insured	1.36	(0.74-2.50)	0.69	(0.36-1.34)			0.54	(0.24-1.22)
Pregnancy								
Not Pregnant	Ref	Ref			Ref	Ref	Ref	Ref
Pregnant	2.70	(0.90-8.14)			1.93	(0.59-6.28)	1.71	(0.42-6.99)
Parity								
First birth	Ref	Ref			Ref	Ref	Ref	Ref
2 or subsequent birth	**2.87***	(1.32-6.21)			**3.20***	(1.51-6.79)	1.88	(0.69-5.17)
Smoking								
No	Ref	Ref			Ref	Ref	Ref	Ref
Yes	0.97	(0.48- 1.96)			0.70	(0.33-1.52)	0.80	(0.33-1.94)
Depression								
No	Ref	Ref			Ref	Ref	Ref	Ref
Yes	1.61	(0.63-4.11)			1.11	(0.38-3.26)	0.91	(0.26-3.13)
Sleep								
Normal (7-10h)	Ref	Ref			Ref	Ref	Ref	Ref
Abnormal (<7 or >10)	1.24	(0.70-2.21)			1.21	(0.63-2.33)	0.89	(0.40-2.02)
Tired/Fatigue								
No	Ref	Ref			Ref	Ref	Ref	Ref
Yes	1.67	(0.90-3.10)			1.70	(0.81-3.55)	**2.45***	(1.08-5.57)
Obesity								
Normal BMI (<30)	Ref	Ref			Ref	Ref	Ref	Ref
Obese BMI (>= 30)	**3.04***	(1.66-5.59)			**2.51***	(1.35-4.65)	**2.72***	(1.33-5.56)

C-Section						
Never c-section	Ref	Ref	Ref	Ref	Ref	Ref
History of c-section	1.74	(0.92-3.28)	1.54	(0.74-3.21)	1.56	(0.65-3.73)
Breastfeeding						
Not breastfeeding	Ref	Ref	Ref	Ref	Ref	Ref
Currently breastfeeding	**0.25***	(0.14-0.46)	**0.26***	(0.13-0.54)	**0.23***	(0.10-0.53)

*p<0.05; SRH modeled on "Poor"

Table 9. Breastfeeding and Poor Self-Reported Health (SRH) Among US Postpartum Women of Reproductive Age (20-44 years), NHANES 2007-2018

	Unadjusted OR		Adjusted OR (Nested Model 1)		Adjusted OR (Nested Model 2)		Adjusted OR (Nested Model 3)		Adjusted OR (Full Model)	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Age (M ± SD)	1.03	(0.97-1.09)	1.03	(0.97-1.09)	1.07	(1.00-1.13)	1.01	(0.94-1.07)	1.02	(0.94-1.11)
Breastfeeding										
Not breastfeeding	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Currently breastfeeding	**0.24***	(0.13-0.44)	**0.20***	(0.11-0.37)	**0.24***	(0.11-0.52)	**0.26***	(0.13-0.54)	**0.23***	(0.10-0.53)
Race/Ethnicity										
Non-Hispanic White			Ref	Ref					Ref	Ref
Non-Hispanic Black			1.09	(0.39-3.05)					0.80	(0.28-2.33)
Hispanic			**4.39***	(1.69-11.92)					**3.51***	(1.20-10.27)
Other			2.93	(0.80-10.64)					3.57	(0.84-15.20)
Acculturation										
High			Ref	Ref					Ref	Ref
Low			0.97	(0.39-2.39)					0.92	(0.30-2.81)
Education Status										
Less than high school					Ref	Ref			Ref	Ref
High school					**0.30***	(0.13-0.68)			**0.35***	(0.13-0.95)
Some college					**0.29***	(0.14-0.60)			0.44	(0.19-1.04)
College					**0.22***	(0.06-0.71)			0.33	(0.09-1.29)
Family IPR										
<100%					Ref	Ref			Ref	Ref
100-199% FPT					1.47	(0.77-2.81)			1.66	(0.81-3.41)
200% - 399% FPT					0.55	(0.23-1.34)			0.61	(0.23-1.64)
≥400 FPT					0.34	(0.04-2.97)			0.50	(0.04-5.50)
Marital Status (%)										
Married/Partnered					Ref	Ref			Ref	Ref
Not Married/Partnered					0.71	(0.35-1.45)			0.65	(0.28-1.49)

Employment Status						
Employed	Ref	Ref			Ref	Ref
Not Employed	1.88	(1.00-3.52)			1.59	(0.79-3.21)
Insurance Status						
Insured	Ref	Ref			Ref	Ref
Not Insured	0.64	(0.33-1.25)			0.54	(0.24-1.22)
Pregnancy						
Not Pregnant			Ref	Ref	Ref	Ref
Pregnant			1.93	(0.59-6.28)	1.71	(0.42-6.99)
Parity						
First birth			Ref	Ref	Ref	Ref
2 or subsequent birth			**3.20***	(1.51-6.79)	1.88	(0.69-5.17)
Smoking						
No			Ref	Ref	Ref	Ref
Yes			0.70	(0.33-1.52)	0.80	(0.33-1.94)
Depression						
No			Ref	Ref	Ref	Ref
Yes			1.11	(0.38-3.26)	0.91	(0.26-3.13)
Sleep						
Normal (7-10h)			Ref	Ref	Ref	Ref
Abnormal (<7 or >10)			1.21	(0.63-2.33)	0.89	(0.40-2.02)
Tired/Fatigue						
No			Ref	Ref	Ref	Ref
Yes			1.70	(0.81-3.55)	**2.45***	(1.08-5.57)
Obesity						
Normal BMI (<30)			Ref	Ref	Ref	Ref
Obese BMI (>= 30)			**2.51***	(1.35-4.65)	**2.72***	(1.33-5.56)

C-Section				
Never c-section	Ref	Ref	Ref	Ref
History of c-section	1.54	(0.74-3.21)	1.56	(0.65-3.73)

Table 10. Obesity and Poor Self-Reported Health (SRH) Among US Postpartum Women of Reproductive Age (20-44 years), NHANES 2007-2018

	Unadjusted OR		Adjusted OR (Nested Model 1)		Adjusted OR (Nested Model 2)		Adjusted OR (Nested Model 3)		Adjusted OR (Full Model)	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Age (M ± SD)	1.01	(0.95-1.07)	1.00	(0.94-1.06)	1.04	(0.97-1.12)	1.01	(0.94-1.07)	1.02	(0.94-1.11)
Obesity										
Normal BMI (<30)	Ref	Ref	**Ref**	Ref	**Ref**	Ref	Ref	Ref	Ref	Ref
Obese BMI (>= 30)	**3.03***	(1.65-5.59)	**3.61***	(1.88-6.91)	**2.87**	(1.48-5.60)	**2.51***	(1.35-4.65)	**2.72***	(1.33-5.56)
Race/Ethnicity										
Non-Hispanic White			Ref	Ref					Ref	Ref
Non-Hispanic Black			0.90	(0.34-2.38)					0.80	(0.28-2.33)
Hispanic			**4.05***	(1.51-10.89)					**3.51***	(1.20-10.27)
Other			3.24	(0.92-11.41)					3.57	(0.84-15.20)
Acculturation										
High			Ref	Ref					Ref	Ref
Low			1.16	(0.48-2.80)					0.92	(0.30-2.81)
Education Status										
Less than high school					Ref	Ref			Ref	Ref
High school					**0.31***	(0.14-0.69)			**0.35***	(0.13-0.95)
Some college					**0.30***	(0.14-0.66)			0.44	(0.19-1.04)
College					**0.19***	(0.05-0.67)			0.33	(0.09-1.29)
Family IPR										
<100%					Ref	Ref			Ref	Ref
100-199% FPT					1.65	(0.83-3.29)			1.66	(0.81-3.41)
200% - 399% FPT					0.58	(0.24-1.43)			0.61	(0.23-1.64)
≥400 FPT					0.39	(0.04-3.82)			0.50	(0.04-5.50)
Marital Status (%)										
Married/Partnered					Ref	Ref			Ref	Ref

Not Married/Partnered	0.71	(0.33-1.54)			0.65	(0.28-1.49)
Employment Status						
Employed	Ref	Ref			Ref	Ref
Not Employed	1.60	(0.82-3.14)			1.59	(0.79-3.21)
Insurance Status						
Insured	Ref	Ref			Ref	Ref
Not Insured	0.73	(0.38-1.43)			0.54	(0.24-1.22)
Pregnancy						
Not Pregnant			Ref	Ref	Ref	Ref
Pregnant			1.93	(0.59-6.28)	1.71	(0.42-6.99)
Parity						
First birth			Ref	Ref	Ref	Ref
2 or subsequent birth			**3.20***	(1.51-6.79)	1.88	(0.69-5.17)
Smoking						
No			Ref	Ref	Ref	Ref
Yes			0.70	(0.33-1.52)	0.80	(0.33-1.94)
Depression						
No			Ref	Ref	Ref	Ref
Yes			1.11	(0.38-3.26)	0.91	(0.26-3.13)
Sleep						
Normal (7-10h)			Ref	Ref	Ref	Ref
Abnormal (<7 or >10)			1.21	(0.63-2.33)	0.89	(0.40-2.02)
Tired/Fatigue						
No			Ref	Ref	Ref	Ref
Yes			1.70	(0.81-3.55)	**2.45***	(1.08-5.57)
C-Section						
Never c-section			Ref	Ref	Ref	Ref
History of c-section			1.54	(0.74-3.21)	1.56	(0.65-3.73)

Breastfeeding				
Not breastfeeding	Ref	Ref	Ref	Ref
Currently breastfeeding	**0.26***	(0.13-0.54)	**0.23***	(0.10-0.53)

Chapter 5: Discussion and Conclusion

Summary

This is the first study to use a nationally representative sample to explore the self-reported health of US women in the postpartum and provides new insights into the health status of postpartum mothers in the U.S. The findings suggest that, on average, for US women who are not pregnant, the postpartum period is associated with improved SRH compared with women of reproductive age who are not postpartum. This has not been previously reported for a US population, but is consistent with existing, albeit mostly international, literature on SRH in the postpartum period. A novel finding is that women who are pregnant in the 12 months following childbirth do not experience the expected protective effect of postpartum status on SRH and appear to be at elevated risk of reporting poor SRH. The examination of the relationship between SRH and various socio-demographic and health factors in the postpartum period revealed that Hispanic ethnicity, tiredness and obesity have a negative relationship with maternal SRH, while a high school education and current breastfeeding status are associated with a protective effect on SRH. A more detailed discussion on each of these key findings follows below. Implications for future research, policy and clinical practice are included in each section.

Postpartum Status and Maternal SRH

For women who are not pregnant, being postpartum is associated with better SRH. A protective effect of postpartum status on SRH has not been previously described for a US population and is somewhat counter-intuitive given the known

challenges of early parenthood and high prevalence of physical health concerns reported by US women in previous studies of the postpartum period.[26,31,32] Several factors could explain this seeming paradox.

Expectations are a known modulator of the adjustment to parenthood.[133–135] The role of realistic expectations during the postpartum transition have been discussed elsewhere,[136] and may help explain why women may rate themselves as having positive health even when they have numerous physical concerns. Postpartum mothers may expect the demands of early parenthood and an uncomfortable period of physical recovery as a normal part of the postpartum period and this expectation may reduce the impact of childbirth-specific health concerns on maternal SRH. Qualitative research lends support to the theory of a normalization of these concerns by mothers[137,138] who, in effect, seem to "discount" postpartum health concerns as they formulate an answer to the SRH question.[138]

Another possible explanation for the protective effect of postpartum status on SRH is that women who have recently given birth may compare their current health to that in late pregnancy. Women's SRH seems to be affected negatively by advancing pregnancy, with a nadir in the third trimester.[101,108,139] It may be, therefore, that, when compared to the recent physical demands of late pregnancy, women may feel that they are in better health in the postpartum. This positive feeling may be further bolstered by the feeling of accomplishment of having gotten through the experience of childbirth.[138]

Finally, it may be, that women who recently were able to achieve and successfully carry a pregnancy through to a live birth are in fact, on average, healthier

than the reference group of women of the same age. There is a positive relationship between women's general health, fertility and reproductive outcomes.[132] Similarly, those women who feel healthier may be more likely to attempt pregnancy - this has been referred to as a "healthy mother effect".[140]

Pregnancy and Maternal SRH

The protective effect of postpartum status in terms of SRH is not present for women who are pregnant again in the 12 months following the birth of a child. Additionally, my findings suggest that pregnancy in the first postpartum year is detrimental to maternal SRH. These are novel findings, but consistent with what is known about the health impacts of closely spaced pregnancies.[141–147] The time between the end of one pregnancy and the conception of the next is referred to as an interpregnancy interval (IPI). Short IPIs, which are typically defined as those less than 18 months, are associated with adverse perinatal outcomes including preterm birth and low birthweight.[141,142,144,147] These adverse outcomes also include adverse maternal obstetric outcomes during the subsequent birth, including abruption and uterine rupture.[142,146,148,149]

The reduction in the proportion of US pregnancies with IPIs less than 18 months is a national health goal for 2030[150]; however, currently there is no national recommendation for an optimal IPI. The American College of Obstetricians & Gynecologists (ACOG) recommends that providers counsel patients to avoid IPIs less than 6 months and on the risks and benefits of a repeat pregnancy less than 18 months .[151] The current content of this counseling vis-à-vis maternal outcomes is focused on obstetric outcomes. The World Health Organization recommends a minimum IPI of

24 months in order to reduce the risk of adverse maternal, perinatal and infant outcomes.[152] The evidence on which this guideline is based relies heavily on international studies, which has led US experts to question its applicability to a US population and to call for a reexamination of the research linking short IPIs to adverse perinatal outcomes.[141,148] Among the results of this examination is the identification of a lack of informative US data on non-obstetric maternal health effects of short IPIs.[143,144,148] Self-reported health may capture the sub-clinical and non-clinical effects of pregnancy on maternal health. There is a need for additional research to confirm my results and to better characterize potential maternal health impacts of short IPIs to better inform, among other things, the content of the recommended counseling on the risks and benefits of short IPIs.

My findings underscore the need for effective strategies to ensure access to and uptake of postpartum contraception. An estimated 15% of pregnancies in the US occur within 12 months of the previous pregnancy,[153] approximately 70% of which are unintended.[154] This signals a significant unmet need for postpartum contraception. One barrier to postpartum contraception is the postponement of contraceptive initiation until the 6-week postpartum visit. Approximately half of women (49.4%) women will not attend this postpartum visit[155] and up to 50% may already have had unprotected intercourse prior to the visit. Given than approximately half of non-lactating women ovulate before the sixth postpartum week,[156] waiting until the 6-week postpartum visit to initiate contraception means exposure to a risk of unintended pregnancy even for those intending to initiate a contraceptive method at 6 weeks. Even at the 6-week postpartum visit; however, there are barriers to

contraceptive initiation.[157] The immediate postpartum initiation of long-acting reversible contraception (LARC) during the birth admission has been demonstrated as effective ways to prevent unintended pregnancy and increase IPI,[155,158,159] yet the availability of this option is still limited, even for women who desire it.[160] Insurance-related barriers are a key contributor to this limited availability to in-hospital and postpartum visit LARC initiation. State initiatives to removes some of these barriers and increase access to in-hospital LARC have achieved success[161–163] Same day start of LARC contraception at the postpartum visit[157] and flexible scheduling of that postpartum visit to meet maternal needs[5] are additional strategies for improving timely postpartum contraception initiation.

Predictors of Postpartum SRH

The fourth aim of this study was to identify predictors of SRH in the US postpartum population. Education, Hispanic ethnicity, tiredness, breastfeeding and obesity emerged as independent predictors of SRH in these analyses.

Education

A high school education was found to be protective in terms of maternal SRH in the postpartum period. This finding is not surprising given the well-established positive relationship between educational attainment and health.[164,165] In addition to being more likely to report poor health,[166] those without a high school education are more likely to report chronic health conditions[167] and to have a premature death.[168,169] This relationship is reflected in SRH studies,[170–172] including those using samples representative of US civilian population.[89,170] If the evidence supporting educational attainment as a potent determinant of health is extensive, so is the body of literature

on the potential mechanisms through which educational level and health are related. While these mechanisms are not yet fully understood, they can be organized into three general pathways – 1) those that enhance employability and income; 2) those that improve a sense of control/agency, social standing and social support and 3) those that increase the ability to negotiate healthcare systems and adopt healthy behaviors.[164,171]

Health literacy, which is defined by the US Department of Health and Human Services as "the degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others,"[173] falls into the third category of pathways connecting education and health. Health literacy has been found to partially mediate the association between low education and low SRH[174] and interventions to improve health literacy have been demonstrated to improve health literacy and promote positive behavioral change.[175,176] As it provides an opportunity to ameliorate the impacts of lower formal education attainment on health outcomes, health literacy is an important tool in efforts to reduce health disparities and thus has been adopted as a key national health promotion strategy.[173]

My findings support the use of interventions specifically designed to improve maternal health literacy as a way to improve maternal health in the postpartum period. Pregnancy is a time of increased contact with the healthcare system and also a time of transition when women may be particularly motivated to make positive behavioral change,[177,178] making this a critical window of opportunity for postpartum health promotion. There is limited research on the efficacy of interventions specifically

designed to improve health literacy in pregnancy and postpartum,[179] it is possible that improvements in health literacy accounts for some of the impact of group antenatal care on certain pregnancy related outcomes,[180,181] but this has not been well studied in a US context.

Hispanic Ethnicity

Even after controlling for acculturation, Hispanic ethnicity was independently associated with poor SRH among women of reproductive age and was also a predictor of poor SRH in the postpartum period. The unexpected yet consistent finding of Hispanic ethnicity as a predictor of poor SRH was described earlier. While caution is warranted when making cross race/ethnic comparisons of SRH, caution is also warranted in explaining away or dismissing these findings as an artifact of cultural/language variation in interpretation of SRH. The latter may lead to neglect of a population that might actually be in poorer postpartum health - this would be particularly problematic at a time when it has become clear that neglected disparities in maternal health can have devasting consequences.[182–184] Most recently, the disproportionate impact of COVID-19 on Hispanic mothers[185,186] provides a troubling sign that Hispanic women in the peripartum population may indeed be particularly vulnerable to health threats, and underscores the need for more work in this area.

Not much is known currently about the experience of new motherhood among the US Hispanic population. The Listening to Mothers project conducted a study in California using a sample of more than 2,500 women representative of California residents 18 years and older who gave birth to a single baby in California hospitals in 2016.[187] The survey was conducted in both English and Spanish and provides

additional evidence that Hispanic mothers may be particularly vulnerable to experiencing compromised health in the perinatal period. Their findings suggest that this vulnerability may be due at least in part to inability to fully access their networks of support. Latinas were much more likely than White women to report a lack of sources of emotional or practical support after childbirth. Nearly 20% of Latinas reported they never had someone to turn to for emotional or practical support, while only 5% of White women lacked access to support. Poor social support has been associated with poor SRH in previous studies[101,105,106,110,113] and has been identified as a cornerstone of postpartum health.[136] A measure of social support was not available in NHANES for the time period under study, therefore, this relationship could not be explored in the current study. The findings of the LTM California study, however, indicate that social support may be a particularly important driver of SRH in this population.[187]

An important limitation in many studies on SRH, including this study, is that that by grouping all individuals of Hispanic origins into one category there is an assumption of homogeneity among this population that may obscure important patterns of health disparities within that group. Future research in this area needs to pay particular attention to identify within-group differences in the Hispanic population.

Tiredness

Tiredness was independently associated with poor maternal SRH, even after controlling for abnormal sleep duration. This association between maternal SRH and tiredness was expected given the findings in non-SRH literature that maternal

tiredness/fatigue/exhaustion is a common postpartum concern[31,109,110,120–122] and the known relationship between tiredness/fatigue and maternal SRH.[96,109,110] In addition to its negative impact on maternal health, fatigue adversely impacts parenting behaviors.[188–190] Maternal fatigue in the postpartum is a complex, dynamic state that has not been fully characterized[191]; however, literature on its determinants demonstrate a consistent relationship with depression,[190,192–194] low iron[195–197] and sleep disturbances.[190,192,193,198] Many of the interventions to address maternal fatigue focus on improving sleep quality.[199] Maternal fatigue, though, can be present without sleep problems[200] and, as demonstrated in this study, can have and independent relationship from sleep on maternal well-being.[109] Additional proposed strategies to prevent or manage fatigue include prolonged, paid maternity leave,[201] enhanced social support, routine assessment of need for iron and thyroid supplementation,[195] and psychoeducational interventions.[202] Most of these have not been well studied or implemented on a large scale. This study provides additional evidence to support calls for the routine assessment of postpartum mothers for the presence of tiredness/fatigue[195] and when present, for its impacts on maternal health and parenting. More importantly perhaps, it underscores the need for identification and implementation of successful and scalable interventions aimed at relieving maternal fatigue and/or its impacts.

Obesity

Although the relationship between obesity and SRH has not been previously described for a postpartum population, obesity has a known negative relationship with SRH in previous studies in other populations.[203–207] In the US, in 2019, nearly one in

three (31.6%) women of reproductive age was obese and that about half of women who become pregnant, enter pregnancy overweight or obese.[208] Prevention of maternal obesity and mitigation of its associated health impacts is a priority of national and international health agencies [94]

Maternal obesity increases risks for complications of pregnancy and childbirth[209,210] and is associated with elevated health risks to mothers in the postpartum period and in the long-term[210,211] including postpartum depression,[212] long-term obesity,[211,213] diabetes and hypertensive disorders.[210] It must be noted that no additional physical morbidities were included in this study. Controlling for obesity-related conditions such as hypertension and diabetes may impact the strength of the association between obesity and SRH in this population.

Breastfeeding

The protective relationship observed between SRH and breastfeeding could mean that women who feel healthier are more likely to choose to breastfeed and/or to continue to breastfeed. Alternatively, it may be that a successful breastfeeding experience can create a sense of maternal well-being that is reflected in SRH. A negative breastfeeding experience, by contrast, is associated with poor SRH[110,112] and poor SRH been demonstrated to be a predictor of premature breastfeeding discontinuation.[102,117] These findings support a dynamic relationship between maternal sense of health as measured by SRH and the decision and/or ability to breastfeed. A woman who generally feels healthy may not only be physically more capable of breastfeeding than a mother who does not feel healthy, but additionally, she may be better able to overcome common breastfeeding difficulties. Conversely,

women who feel that that they are not in best health may feel that they are not healthy enough to breastfeed.[214] While this all makes intuitive sense, the promotion of overall maternal health is seldom referenced as a strategy for improving initiation and continuation of breastfeeding. Additional studies that confirm these findings and that examine the impact of interventions to improve maternal subjective sense of health on breastfeeding initiation and continuation are needed. An additional related area for further study is the relationship between obesity, SRH and breastfeeding. Obese women are less likely to initiate breastfeeding as well as more likely to discontinue breastfeeding prematurely and experience lactation failure[215,216] a relationship that may be mediated by SRH.

Strengths and Limitations of the Current Study

This study is that it is the first to explore postpartum SRH in US women using a nationally representative sample. Additionally, the use of multiple years of NHANES permitted the creation of a sample size of sufficient size to make it possible to examine interactions of interest such as that between postpartum status and pregnancy while controlling for numerous potential confounders. The use of a data set not specifically created to study postpartum outcomes is both a strength and a limitation of this study. It reduces the risk of selection and recall bias based on factors that could be associated with postpartum status or other factors of interest such as breastfeeding. This, in turn, increases the likelihood that the relationships observed in this study accurately reflect those that exist in the US postpartum population. However, it also means that certain variables of interest such as social support, pregnancy and childbirth complications and maternity leave, are either not

assessed at all or are not assessed in the desired detail. For example, while NHANES asks about an ever-history of cesarean section, it does not ask a woman to specify which of her births was via c-section. Therefore, unless the index birth (the birth from which she is in postpartum status) is her first birth, it is not possible to tell whether or not the index birth was via C-section. This limits comparability to other studies and also may explain why this study failed to find the expected association between C-section and poor SRH. It is also possible that expected associations such as this one were not observed because, despite the use of multiple waves of the survey, the postpartum sample was still too small. There are certain populations of interest such as adolescent mothers and those mothers who experienced a fetal demise that were not included in the sample and others, such as those experiencing the death of an infant that could not be identified. While this study purposely used a nationally representative sample to study postpartum SRH, further exploration of SRH using surveys that specifically recruit postpartum women, such as PRAMS may allow investigators to overcome the limitations related to sample size, albeit with some loss of generalizability.

Not all the individuals who were selected for the MEC component of NHANES completed the depression screen (DPQ) and the reproductive health questionnaire (RHQ) from which the postpartum population was identified. Non-response to the RHQ could have an impact on the generalizability of the results, however, this impact, if present, is likely minimal. There is no a priori reason to believe that the women who did not participate in the MEC differed in likelihood of being postpartum. Additionally, NHANES, sampling strategies and MEC weights

mitigate the impact of this component non-response. A comparison of respondents and non-respondents in this study revealed no difference in SRH, the outcome of interest.

Finally, an important limitation of this study is that it is cross-sectional and therefore it is not possible to determine the temporal relation between maternal SRH and certain variables of interest, such as breastfeeding or return to work.

Conclusion

Due to SRH's ability to capture a broad assessment of health that includes subclinical and non-clinical determinants of health, the results of this study provide a different perspective on the postpartum health of US mothers than the one provided by extant studies which have focused mainly on maternal morbidity and mortality. The more complete perspective that emerges is one in which the postpartum period, despite its challenges and high prevalence of health concerns, is perceived by most women as a time of positive health. Nonetheless, 1 in 10 postpartum women report being in fair or poor health. This study also provides information regarding the potential threats to postpartum SRH, including obesity and pregnancy.

This study provides novel information regarding the relationship between a short IPI and maternal SRH that suggests a need for more research, public health and clinical attention focused on the health needs of those mothers with closely-spaced pregnancies. Additionally, my findings underscore the importance of promoting pregnancy prevention in the first postpartum year as a key postpartum maternal health goal in and of itself, independent of a woman's future reproductive plans or potential

implications for future pregnancies and births. Our understanding of the risks of short IPIs is based on data on clinically identifiable outcomes.

I found that women who are currently breastfeeding were less likely to have poor SRH. This is consistent with previous research demonstrating that maternal SRH predicts breastfeeding initiation and continuation. There is a continued need to promote breastfeeding as a way to help promote maternal health, including maternal health in the postpartum period, but there is also a need to consider that enhancing maternal sense of health may be in and of itself as a strategy to facilitate breastfeeding and other healthy behaviors. It makes intuitive sense that if women feel healthier, they will also be better able to engage in health enhancing activities for themselves, their infants and their families. My results suggest that efforts to address maternal fatigue and maternal obesity may be particularly important in optimizing this maternal sense of well-being. This is particularly significant given that the postpartum maternal brain may be particularly primed for health enhancing interventions. Recent findings from the field of neurology demonstrate that in the postpartum period there is a neural plasticity of the maternal brain in both structure and function that is believed to promote the ability of women to manage the new and demanding tasks of parenting (Barba-Müller, Craddock, Carmona, & Hoekzema, 2019; Kim, Strathearn & Swain, 2016). This neural plasticity may help explain resilience of maternal SRH to the challenges in this time period. From what is known about other periods of neuronal plasticity, the maternal brain in this period is likely to be particularly vulnerable to negative experiences (Barba-Müller, Craddock, Carmona & Hoekzema, 2019), but also highly responsive to positive ones, including health-

promoting interventions (Kim, 2016). These finding, as do ours, suggests a benefit to reframing our approach to the postpartum period so, that in addition to identifying and protecting those who are vulnerable to known health threats, we also find ways to enhance the health of all postpartum mothers so that they can best capitalize on what appears to be their innate adaptability and the generally salutiferous nature of this time period.

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Appendix 1

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INSTITUTIONAL REVIEW BOARD

1204 Marie Mount Hall
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DATE:	March 4, 2020
TO:	Jenifer Fahey, MSN, MSPH
FROM:	University of Maryland College Park (UMCP) IRB
PROJECT TITLE:	[1565967-1] The Self-Rated Health of US Postpartum Women
REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	March 4, 2020
REVIEW CATEGORY:	Exemption category # *4*

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

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