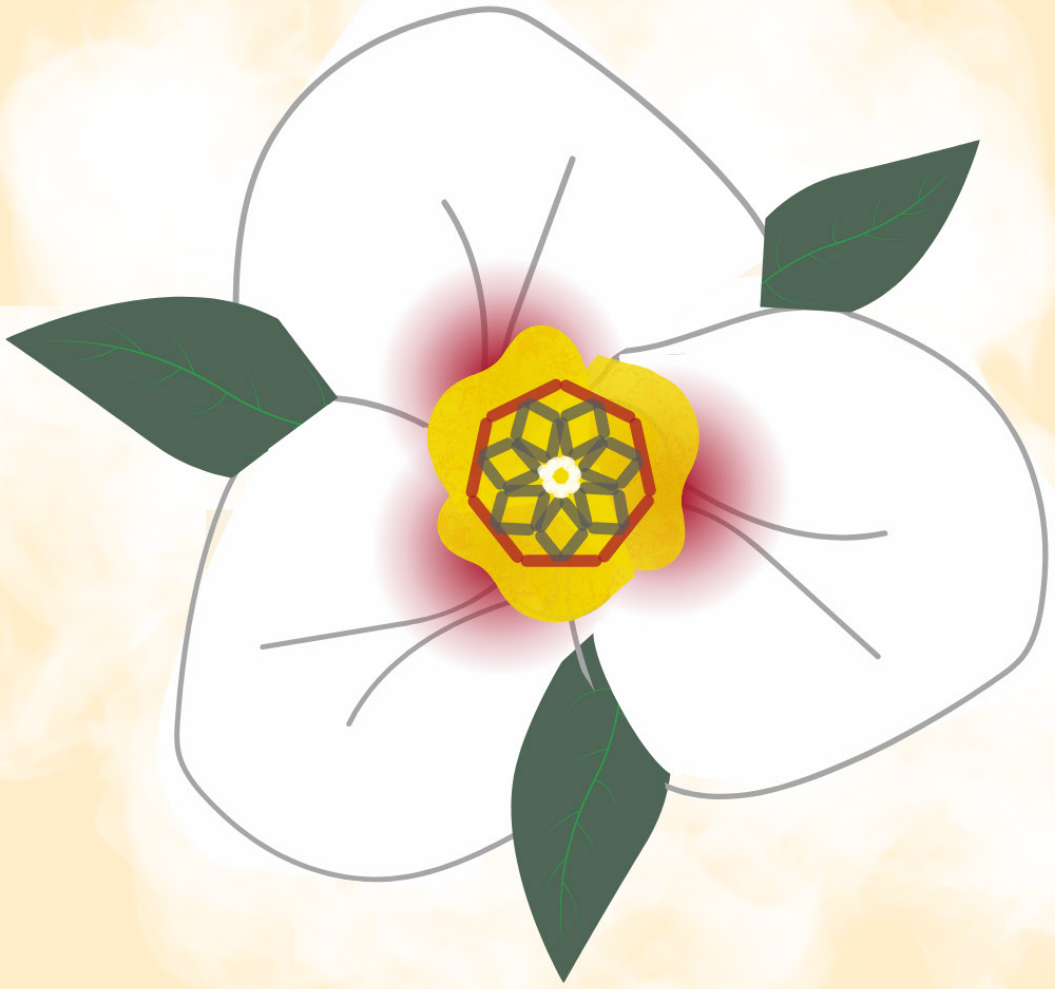
UWHR 2022

THE UTAH WOMEN'S HEALTH REVIEW



The Center of Excellence in Women's Health
UNIVERSITY OF UTAH

Masthead

Volume 2 Number 1 May 2022

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Letter from the Editor

Welcome to the fourth annual issue of *The Utah Women's Health Review*! On behalf of the editorial board and our dedicated staff, we are thrilled to present a diverse collection of original manuscripts that explore the intricacies of women's health across the 7 Domains of Health.

In these eleven thought-provoking contributions, our authors delve into critical aspects of women's well-being, shedding light on sex and gender health disparities. This issue holds a special place in our hearts as we navigate the complexities of women's health against the backdrop of our ever-changing world.

This year's issue includes two original research articles, seven insightful commentaries, and two illuminating data snapshots. Each piece thoughtfully examines at least one domain of health, contributing to our understanding of the multifaceted nature of women's health. Additionally, we provide a link to the recorded proceedings from the 2022 "Abortion to Gen Z: Equity and Inclusion in Sex, Gender, & Women's Health Virtual Symposium."

Anxiety, Depression, and Pregnancy during COVID-19 (Valcarce et al): A meticulous exploration of anxiety and depression rates among pregnant women in Utah during the COVID-19 pandemic, urging a closer look at maternal mental health and the need for enhanced support and resources.

Pregnancy & Opioid Addiction (Ellsworth and Adediran): Unpacking the critical impact of opioid addiction on pregnant women and infants, addressing treatment gaps, and calling for further research to guide effective interventions.

The Consequences of Menopause on Cognitive Functioning (Ewoniuk): A compelling analysis of menopause's impact on cognitive health, advocating for increased awareness and education, especially within the medical community.

Menstrual Cycle's Effect on Women's Intellectual Health (Spackman and Arteaga): Addressing the impact of menstruation on the intellectual health of women and girls, emphasizing potential negative effects and calling for increased understanding and awareness about menstruation to support women and girls intellectually.

Period Poverty (Adediran and Myrer): Tackling the pervasive issue of period poverty, defined as the inability to access affordable sanitary products, hygiene facilities, and menstrual hygiene education. The commentary well summarizes legislative efforts and policy recommendations, within and beyond Utah, to alleviate period poverty's health and economic burdens.

COVID-19 Severity in Utah (Paegle et al): A comprehensive study revealing disparities in COVID-19 illness severity across demographic groups in Utah, emphasizing the need for targeted interventions.

Women in Post-Secondary Education: Utah Fails to Thrive (Turner): Analyzing trends and challenges faced by women in Utah's educational landscape, calling for awareness, resources, and support to empower women in pursuing higher education.

Reproductive Health Literacy Among Adolescent Women in Utah (Waechtler): Addressing inadequate reproductive health literacy among adolescent women and proposing solutions to bridge educational gaps.

Do Interventions Targeting Women Impact Children's Health Behaviors (Nava et al): An in-depth research article investigating changes in fruit and vegetable consumption and physical activity among children, revealing the potential impact of interventions focused on enhancing women's health behaviors on the well-being of children and household members.

Obesity in Pregnancy and its Effects: Utah 1993–2020 (Bellows et al): A data snapshot addressing the

prevalence of obesity during pregnancy in Utah and its associated consequences, calling for public health efforts to encourage healthy weight and lifestyles.

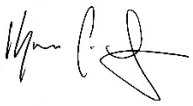
Intellectual Health During Pregnancy (Harward et al): A commentary focusing on how pregnancy induces significant changes in a person's brain structure, impacting intellectual health. Despite limited literature on this topic, the commentary recommends increased basic research to understand physiological and cognitive changes during and after pregnancy, development of evidence-based health education materials addressing health literacy challenges, and exploration of ways to support intellectual health amid pregnancy-related changes.

As we present these insightful articles, we encourage you to reflect on the issues discussed and consider the broader implications for women's health. Our call to action resonates throughout, urging a collective effort to address disparities, enhance education, and advocate for the well-being of women in Utah and beyond.

We extend our heartfelt gratitude to the authors, reviewers, and readers who contribute to the success of The Utah Women's Health Review. Your support empowers us to continue exploring, understanding, and championing the diverse facets of women's health.

We look forward to receiving and reviewing your submissions in the coming years, as we continue our mission to advance knowledge and promote positive change in women's health.

Warm regards,



Karen Schliep, PhD MSPH
Utah Women's Health Review
Editor-in-Chief

Abortion to Gen Z:

Equity and Inclusion in Sex, Gender, & Women's Health Virtual Symposium 2022

Visit the virtual symposium at https://uwhr.utah.edu/sex-gender-and-womens-health-across-the-lifespan-2022/ for video presentations, Q&A, abstracts, and posters.

Inflammatory Depression and Women	Mark Rapaport, MD, Huntsman Mental Health Institute & University of Utah
Perinatal Mental Health	Lauren Gimbel, MD, University of Utah
Social Determinants, Risks, and Needs: Implications for Promoting Health, Equity, and Inclusion	Andrea Wallace, PhD, University of Utah
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Treatment Response Over Time in Women with Urgency Urinary Incontinence: A Novel Approach	Whitney Hendrickson-Cahill, MD, University of Utah
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After Roe: Impact of RE-Criminalization of Abortion on Medical Care, Medical Education and the Lives (and Rights) of Pregnant People	Lisa Harris, MD, PhD, Institute of Healthcare Policy and Innovation, University of Michigan
The Ethics of Access: Adding Health Care Disparity and Reproductive Justice Perspectives to Discussion of Abortion and Conscience	Katie Watson, JD, Northwestern University Feinberg School of Medicine

Comparison of Anxiety and Depression among Women Who Gave Birth in Utah 2016-2020 Using the Pregnancy Risk Assessment Monitory System (PRAMS)

Karen Valcarce, Rachel Myrer, & Jennifer Garces
/ University of Utah

Background

Throughout the world, individuals have experienced multiple adverse physical outcomes as a result of the COVID-19 pandemic; in addition, they have been impacted by unfavorable mental health outcomes arising from the pandemic.[1] Pregnant women are especially vulnerable to mental health distress during times of national crises.[2] Depression and anxiety during pregnancy can have adverse effects on both mother and child. In one study, maternal depression during pregnancy was associated with inflammation.[3] Inflammation during pregnancy has been shown to be associated with increased risk of mental illness or neurological development problems in children.[4] In another study, among women with depression during pregnancy, rates of preeclampsia, premature membrane rupture, preterm delivery, cesarean section, intrauterine fetal death, and intrauterine fetal growth restriction were elevated compared to women who did not report depression during pregnancy.[5] Furthermore, maternal depression during pregnancy has been shown to be associated with lower child cognitive development.[6] Given the importance of mental health during pregnancy to help prevent adverse health outcomes, the objective of this data snapshot is to determine how prevalence of anxiety and depression among pregnant women in Utah have changed over time, notably before and during the COVID-19 pandemic, and to describe the resources available to pregnant women to address mental health.

Data

The Pregnancy Risk Assessment Monitory System (PRAMS) is an ongoing, population-based surveillance project coordinated by the Centers for Disease Control and Prevention (CDC). Through a collaboration of the CDC and the Utah Department of Health (UDOH), Utah is 1 of 47 states that collect PRAMS data. PRAMS surveillance in Utah began in 1999 with the intent to monitor maternal and child health indicators. Based on Utah birth certificates, approximately 200 new mothers are randomly selected for participation each month. Following a protocol developed by the CDC that utilizes mail and telephone questionnaires, approximately 60 percent of new mothers who are randomly selected respond. The responses are weighted to be representative of all women who have live births in Utah.[7] The data included in this snapshot was collected between January 1, 2016, and December 31, 2020.

The standardized approach of the PRAMS data collection is a strength, as PRAMS' stratified random sampling means that women from some groups are sampled at higher rates to ensure adequate data are available for target populations. UT-PRAMS oversamples women of lower education levels and infant birth weight to generate data on at-risk populations. The CDC-standardized PRAMS questionnaire also allows for comparisons between states and across multiple years. Another strength of PRAMS is the breadth and depth of collected data. The questionnaire seeks information on demographics and preconception-, pregnancy-, and postpartum health-related behaviors, attitudes, and health outcomes. However, PRAMS data are self-reported and may be subject to social desirability and recall biases.

Results

Depression and anxiety rates among pregnant women in Utah rose notably between 2016 and 2020 (Table 1 and Figure 1). Rates of anxiety during pregnancy had an absolute increase of more than 14 percent (20.9% to 35.0%), and depression increased by more than 7 percent (16.7% to 24.1%) during this period. The confidence intervals for rates of both anxiety and depression do not overlap between 2019 and 2020. This increase has a devastating impact on the emotional and physical health of mothers and their children. While it is immediately unclear why rates of anxiety and depression during pregnancy were rising between 2016 and 2020, the COVID-19 pandemic could partially explain the increases in more recent years, from 2019 to 2020 (7.0% absolute increase in anxiety, and 5.4% absolute increase in depression). In a study with Canadian women conducted for the same time period, increased anxiety and depression were observed during pregnancy compared to pre-pandemic pregnancy cohorts. Several reasons were cited for this increase related to the pandemic, including social isolation, relationship stress, less access to prenatal care, and concern about the threat of COVID-19 to the health of the mother and baby.[8]

Table 1. Anxiety and Depression among Pregnant Women in Utah (PRAMS, 2016-2020)

Year	Total PRAMS Sample of Pregnant Women with Anxiety Respondents	Percent of Pregnant Women with Anxiety	Total PRAMS Sample of Pregnant Women with Depression Respondents	Percent of Pregnant Women with Depression
2016	320	20.86%	247	16.74%
2017	402	25.99%	275	17.2%
2018	318	23.55%	267	19.37%
2019	485	28.06%	342	18.78%
2020	514	35.01%	362	24.14%

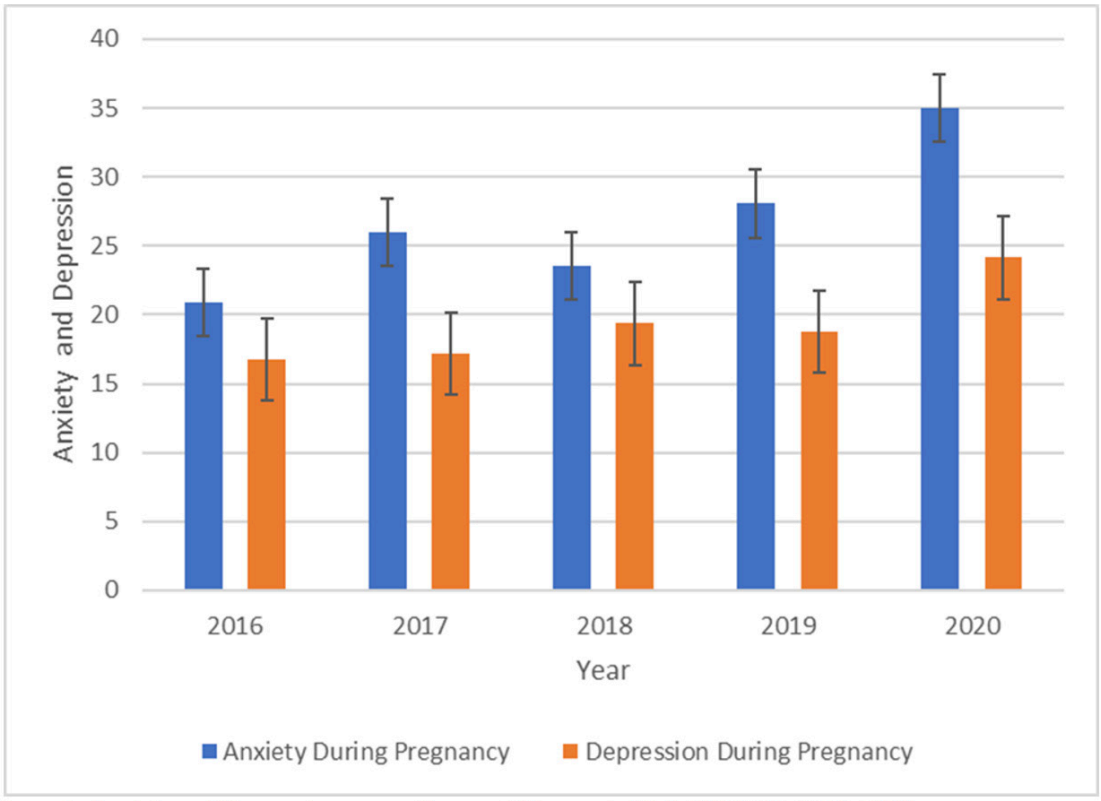

Figure 1: Anxiety and Depression among Pregnant Women in Utah (PRAMS, 2016-2020)

Conclusion

Rates of anxiety and depression among pregnant women in Utah have been increasing since 2016. This is in line with findings from other US states of pregnant women who have shown a more pronounced increase in anxiety and depression during the pandemic compared to before the pandemic.[1] Anxiety and depression during pregnancy not only negatively affect the emotional and physical health of the mother, but also can negatively impact the health of the baby. It is fair to speculate that increased rates of depression and anxiety also cause an increase in the adverse health outcomes discussed above, such as rates of preeclampsia, premature membrane rupture, preterm delivery, cesarean section, intrauterine fetal death, intrauterine fetal growth restriction, and lower cognitive development of the infant.

There are a few recent studies that have addressed what factors may help decrease the risk of anxiety and depression during pregnancy, specific to the context of the COVID-19 pandemic. Lebel, et al., found that increased social support and increased exercise were protective factors.[8] Similarly, Khourry, et al., found that social support was associated with lower amounts of mental health problems during pregnancy.[10] More research is needed, however, on why anxiety and depression during pregnancy may be increasing and what pregnant women and their healthcare providers can do to help reduce the risk of experiencing them in addition to resources currently available. Healthcare providers should screen for anxiety and depression at least one time during pregnancy. Treatments are available, including psychotherapy or antidepressants.[9] UDOH offers a Maternal Mental Health Referral Network, which allows individuals to search for mental health providers throughout Utah by county, provider type, insurance, and specialty.[11] The University of Utah also has a dedicated webpage with information about mental health problems during and after pregnancy and maternal mental health services.[12] The Utah Women and Newborns Quality Collaborative works with providers statewide to make recommendations on education, screening, detection, and response protocols.[13] Other resources are available, such as the Emily Effect, which allows individuals to share their stories relating to mental health during and after pregnancy.[14] Regardless of their experience during pregnancy, pregnant women with mental health concerns should not hesitate to reach out to their healthcare providers.

Acknowledgements

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Amy Ellsworth & Emmanuel Adediran
/ University of Utah

Background

Opioid addiction during pregnancy can significantly impact the physical, mental, and overall wellbeing of women and their infants. During pregnancy and the post-partum period, women can be much more vulnerable to drug use, drug addiction relapse, and drug-induced mortality.[1] Drug-induced death is the top cause of pregnancy-related death in Utah, with nearly 90 percent of pregnancy-related deaths occurring in the post-partum period and approximately 80 percent of these due to opioid use.[1] Prescription opioids are the primary source of opioid use disorder in pregnant women.[2] In analyses of Medicaid-enrolled women (2000-2007, 2008-2015), Utah repeatedly ranked in the highest category (by rate) of prescription opioid use among pregnant women in the United States.[2,3] Given the persistent rates of opioid use among pregnant women in Utah, attention to the literature and to treatment gaps is warranted.

For treatment of opioid use disorder (OUD), medication assisted therapy (MAT) is usually provided at centers with integrated behavioral therapy, consistent with published standards of care.[4] The use of methadone, buprenorphine, or buprenorphine-naloxone in MAT during pregnancy are well supported in the literature.[5,6]

Head-to-head comparisons of methadone and buprenorphine favor buprenorphine for various neonatal outcomes.[7,8] There are no meta-analyses of these studies, nor studies in mother-newborn dyads, about long-term abstinence for any OUD treatment types including MAT. The assumption may be necessary that treatment modalities studied in the general population with OUD offer similar efficacy for pregnant women with OUD. Generally, MAT ranks highly in efficacy,[9] as does residential treatment,[10] on long-term abstinence from opioids. Unlike with alcohol treatment and continuing abstinence, there are no head-to-head reviews of MAT vs. fellowship-based programs, such as Alcoholics Anonymous (AA) or Narcotics Anonymous (NA), on long-term efficacy for treatment of OUD.[11]

Beyond literature gaps also lie care gaps. State-wide distribution of MAT providers is an issue. A survey by Ragsdale et al (2021) identified areas of significant concern, wherein the majority of pharmacies reported gaps in MAT access in their communities.[12] Factors influencing these gaps included affordability of the medications and/or programs at MAT centers, distance to providers, shortage of providers and specialists, and lack of education and outreach.[12] Prescriber-specific factors for offering MAT include costs associated with methadone and/or buprenorphine certifications (ie, time and money).[13] Where MAT is offered outside of integrated treatment centers, additional factors arise, including risk of diversion and safety of personnel at distribution points, typically pharmacies or clinics.[13]

The Substance Abuse and Mental Health Services Administration (SAMHSA) currently lists 17 treatment centers for integrated MAT and behavioral therapy in Utah.[15] We contacted each of these via phone in February 2022, and 95 percent offered services to pregnant women. Buprenorphine alone was favored for pregnant women by some programs. Of the 17 centers, some offered methadone only, and some centers also offered one or more of the medications that include buprenorphine.

Call to Action

We recommend further research in the following areas: literature review and meta-analyses of methadone vs. buprenorphine on short and long-term outcomes; long-term abstinence studies through the post-partum period and under consideration of residential programs and women-only community-based addiction recovery fellowship groups. Additionally, there are currently no studies on the barriers that Utah prescribers and pharmacies may experience for offering methadone or buprenorphine treatment.

At the point of care, Utah mandates priority access for pregnant women to general opioid treatment programs.[14] However, state-level statutes, including in Utah, define opioid use during pregnancy (or maternal opioid positivity at birth) as child abuse, which poses significant barriers to women seeking treatment.[14] Fear of related legal action may drive pregnant women away from seeking care and/or continued engagement in care.[14] Revision of this statute is recommended.

Accessibility to stand-alone prescribers also demonstrates gaps. In Utah, there are no MAT centers outside of Washington County and the Wasatch front.[15] The Kem C. Gardner Policy Institute at the University of Utah identifies Central Utah, Weber-Morgan, and Tooele counties as top areas of concern.[16] This is due to high rates of opioid-related deaths and low availability of MAT and other treatment options. Names of buprenorphine prescribers, by state and city, are freely available on the internet.[17] Our own analysis of Utah prescribers identified the following central Utah counties of particular concern, due to persistent opioid mortality and zero availability of MAT prescribers: Duschene, Garfield, Grand, Iron, Kane, Piute, and San Pete counties.[17,18]

In conclusion, we emphasize the need for studies in several Utah locations with a focus on overcoming MAT barriers, research on long-term abstinence in mother-newborns dyads, and statutory revision.

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The Consequences of Menopause on Women's Cognitive Functioning

Anna Ewoniuk
/ University of Utah

Problem Statement

All women undergo the menopause transition. According to Mosconi et al, menopause is a "neuro-endocrinological process that impacts aging trajectories of multiple organ systems including the brain."[1] The authors describe how menopause is both a reproductive transition state and a neurological transition "as evidenced by the fact that many menopausal systems are neurological in nature such as hot flashes, disturbed sleep, mood changes, and forgetfulness." Morgan and colleagues point to the ever-growing public health concern of cognitive decline and dementia.[2] Specifically, the authors note, "evidence suggests that midlife may be a critical period in the natural course of dementia. For women, understanding the effects of reproductive aging on cognition in midlife and beyond remains a topic of great interest, particularly given that estrogens are involved in a number of cellular pathways that underlie brain function." The authors also posit the idea that perimenopause may be a "therapeutic window" where hormone therapies could possibly prevent cognitive decline in a woman's later adult life.

Reuben et al conclude that "subjective cognitive decline and the loss of ovarian hormones after menopause have been independently linked to later-life Alzheimer's disease."[3] The authors discuss that several studies have found that "cognitive complaints increased across the menopause transition and were associated with reductions in attention, verbal and working memory… Women taking estrogen-decreasing treatments also had increased cognitive complaints and reduced working memory and executive function."

Status of the Literature

All women undergo menopause, though the experience may happen in different ways: through the natural aging process, by the surgical removal of the ovaries, or as medically-induced menopause that occurs due to radiation therapy and/or chemotherapy. The most widely-believed classic symptoms of menopause are hot flashes and a decreased sex-drive. While these are prominent symptoms of menopause transition, they have become stereotypes that draw attention away from changes in women's brains such as brain fog, lack of focus, and difficulty with word finding. In her 2019 TED talk, Lisa Mosconi notes that both a woman's ovaries and her brain are connected through the neuroendocrine system, and that the "estrogen produced by the ovaries is critical to providing energy to the brain."[4]

Other common symptoms related to estrogen loss result in mood disturbances. Depression and anxiety are more likely to occur after a woman has completed menopause. In their systemic review and meta-analysis, Georgakis et al found that "early menopause is a risk factor for depression in postmenopausal women."[5] A further finding is that "women's age at menopause has been inversely associated with the risk of cardiovascular disease." Women who experience menopause prematurely (<40 years of age) are 3 times more likely to develop multi-morbidity disease, including heart disease, in their 60s.

One of the most notable factors for post-menopausal women is an increased risk for developing dementia and Alzheimer's disease. McCarrey and Resnick state that "observational results from longitudinal studies of surgical menopause indicate that both young and old

women who have undergone bilateral oophorectomy carry an increased risk of cognitive impairment and dementia, as well as reductions in global cognition and memory."[6] While their study focuses mostly on the surgical initiation of menopause, they assume women who undergo menopause naturally will experience the same affects.

Call to Action

For social workers employed in the medical field, it is vital to know and understand how menopause is linked to dementia and Alzheimer's disease. Part of a social worker's responsibility is education. Social workers should educate others in the medical field, including other social workers as well as physical therapists, dieticians, etc, to not only increase their knowledge on the subject but to enable them to share this information with their patients. This knowledge has the potential to impact the lives of women by improving the quality of life in later years. It is evident in the medical literature that compared to men, women are at an increased risk of cognitive decline and dementia. Major stressful events have been associated with the onset of Alzheimer's disease at a younger age, and women seem to have a more abrupt increase in cortisol levels after stress than men, which is even higher in older individuals. Also, "neuroinflammation, which is an emerging Alzheimer's disease pathological feature, has been proposed as a potential mediator to the estrogen depletion effects on cognition" (Georgakis et al 2016). It is critical to know the many health risk factors that may influence the risk for dementia and Alzheimer's disease. An individualized health risk assessment is necessary to determine a woman's risk for cognitive decline in her later years. Based on this assessment, a woman may be a good candidate for menopausal hormone therapy, which could exert neuroprotective effects in the aging process, thus increasing her quality of life.

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Period Poverty

Emmanuel Adediran & Rachel Myrer
/ University of Utah

Problem Statement

Period poverty is defined as the inability to access affordable and clean sanitary products, adequate hygiene facilities, and sufficient menstrual hygiene education.[1] It also includes the lack of safe and private spaces for cleaning and means for disposal of used menstrual hygiene products.[2]

Recent estimates show nearly 500 million women and girls globally suffer from period poverty,[3] with the majority living in low and middle-income countries[2,3] and low-income women living in high-income countries.[1,3] In the United States (U.S.), the prevalence of period poverty is unclear, due to a lack of nationwide assessments and limited research.[1] The small number of available studies in this area show substantial proportions of period poverty in the U.S. In a qualitative study of low-income women, 64% of participants reported experiencing period poverty in the past 12 months.[1] Similarly, a study of high school students reported that 48% suffered from period poverty at least once during the school year.[4] Another study of school-aged women found that 14% of college students experienced period poverty in the past year.[2]

Furthermore, period poverty is not only a financial concern, but can also negatively impact women's health. Some studies have associated period poverty with a heightened risk of depression and anxiety,[2] perceived stigma,[5] and urogenital infections.[6] One study on college students showed that students who experienced monthly period poverty were significantly more likely to be moderately or severely depressed compared to students not experiencing period poverty.[2]

Period poverty may also exacerbate societal and economic inequalities.[7] Women who are unable to manage their periods effectively may miss work or school,[8] which can result in lost income, missed educational opportunities,[8,9] and reduced chances for promotions or salary increases.

The results from these studies examining the risks of period poverty and associated outcomes emphasize the need for greater attention to period poverty and additional policy solutions to address critical determinants.

Call to Action

In 2022, the Utah legislature passed House Bill 162.[10] The bill required Utah schools to provide free tampons, sanitary napkins, or similar products to students in female or unisex restrooms within elementary, middle, junior, and high school facilities. This legislation is part of a nationwide trend to address period poverty. Since 2017, more than 20 bills have been enacted to address period poverty nationwide.[11]

Though the passage of HB 162 is notable progress toward menstrual equity, there are additional policies that could make a dent in period poverty. Not all girls and women experiencing period poverty are able to obtain period products from school. When schools and community centers are closed, as they were during the COVID-19 pandemic, access to products becomes a major challenge. We propose several policies that could close these gaps.

Taxing period products, known as the "tampon tax," refers to period products being taxed as luxury items

rather than as necessities. Period products are as much of a necessity as toilet paper, which is provided free of charge in public restrooms. Today, period products are taxed at the standard rate in Utah. In 2019, after many years of advocacy, Utah legislators passed a tax reform bill to end the tampon tax state-wide.[12] However, the tax reform bill was deemed controversial and repealed before implementation.[12]

Making period products eligible for purchase through the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Supplemental Nutrition Assistance (SNAP),[13] could serve as a viable alternative to the tax reform bill. However, some limitations exist, such as the limited coverage of the program, strict eligibility criteria, and volatility.[14] To mitigate these issues, it may be worthwhile to consider implementing measures such as expanding the scope of tax credits or providing voucher programs specific for period products.

Though Utahns experience lower rates of poverty than the nation (8.9% vs. 12.3%), more women live in poverty than men (9.6% vs. 8.2%).[15] This disparity is even more pronounced in racial/ethnic minorities. For example, 36.8% of Black/African American women live in poverty compared to 21.3% of men.[15] Gaps in higher educational attainment and wage earnings also contribute to this problem.[15] Period poverty continues to be a significant issue locally, nationwide, and on a global scale. Many women and girls still suffer from access to affordable menstrual products and proper hygiene management. More research is needed to understand better the prevalence of period poverty across sociodemographic factors and the effect on women's overall well-being.

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Socio-Demographic Disparities in SARS-CoV-2 Illness Severity; Utah, 2020

Alina J. Paegle, James A. VanDerslice, L. Scott Benson, & Karen C. Schliep
/ University of Utah

Abstract

Objectives: To describe differences in COVID-19 illness severity by race, ethnicity, age, and gender in a Utah population-based sample by examining the likelihood of severe outcomes along an expanded illness severity index.

Methods: This cross-sectional study uses clinical records of individuals tested for SARS-CoV-2 between March 10, 2020, and July 10, 2020, at University of Utah Health facilities. We utilized descriptive statistics and adjusted multinomial logistic regression to assess associations between demographic characteristics and COVID-19 illness severity.

Results: Of the 6445 individuals eligible for this study, 53.3 percent identified as female; 12.6 percent were ≥ 65 years of age; and 61.0 percent identified as White, non-Hispanic or Latino (WNH). Compared to WNH, racial and ethnic minoritized groups had a higher adjusted odds ratio (aOR) of receiving emergency department care or hospitalization (aOR =1.83 [95% CI: 1.09, 3.07]; aOR = 7.11 [95% CI: 2.90, 17.43], respectively). Compared to patients younger than 65 years, patients 65 years or older had a higher probability of receiving emergency department care or hospitalization (aOR =2.94 [95% CI: 1.46, 5.96]; aOR = 10.24 [95% CI: 5.53, 18.97], respectively). Male individuals, as compared to female, had similar probability of receiving emergency department care or hospitalization (OR = 0.72 [95% CI: 0.52, 1.0] and OR = 1.06 [95% CI: 0.80, 1.46], respectively).

Conclusions: We found that COVID-19 illness severity varied by race, ethnicity, and age characteristics in Utah, with greater illness severity disproportionately impacting racial and ethnic minoritized groups and those of greater age. We did not detect differences by gender in this sample.

Introduction

In mid-December 2019, a novel Coronavirus–SARS-CoV-2–was identified in a cluster of patients in Wuhan, Hubei Province, China.[1,2] This virus quickly spread internationally, prompting the World Health Organization (WHO) to declare Novel Coronavirus Disease (COVID-19) a global pandemic on March 11, 2020.[3] Now, more than 3 years after its initial detection and identification, over 100 million cases of COVID-19 have been identified in the United States, resulting in over 1 million deaths.[4]

While disease transmission and mortality are mitigated through vaccination and standard non-pharmaceutical interventions (i.e., physical distancing, masking, etc.), inequitable access to interventions, testing, and treatments combined with existing health disparities have allowed the burden of COVID-19 to persist. While health inequities vary geographically, racial and ethnic minoritized groups, including Black or African-Americans and Hispanic or Latino populations, bear a disproportionate burden of COVID-19-related health disparities, such as infection, morbidity, and mortality. Compared to White, non-Hispanic or Latino (WNH) individuals, racial and ethnic minoritized groups are more likely to contract COVID-19 due to living in higher-density residences and working in occupations requiring in-person presence.[9, 11-14.] These underserved communities also have reduced access to COVID-19

testing services.[10,15]

Racial and ethnic minoritized individuals have been identified as having more severe COVID-19 outcomes, such as hospitalization and death, compared to WNH.[5-7, 7-19] While limited access to healthcare overall can partially explain race and ethnic disparities in COVID-19 morbidity and mortality,[9,16] more detailed insights into COVID-19 outcome disparities are limited. Most studies focus on three levels of illness severity: testing positive, hospitalization, and mortality. The limited literature does not adequately address the severity variation experienced in non-hospitalized individuals.[16,18,20]

Given that racial and ethnic minoritized groups constitute over a quarter of the population in the United States,[21] an understanding of how such populations are affected by COVID-19 illness severity is of great public health importance. Without knowledge of race and ethnicity's effects on the risk of severe illness, targeted surveillance and preventive interventions for at-risk populations are hampered. Understanding the relationship between race, ethnicity, and COVID-19 severity will reduce modeling errors for COVID-19, increase targeted and effective allocation of public health assistance and outreach, and reduce COVID-19-related morbidity and mortality.[6]

To address prior knowledge gaps, this study aims to describe differences in COVID-19 outcome severity by race, ethnicity, and related sociodemographic factors in a Utah population-based sample with minimal selection bias.

Methods

Study Design and Sample Population

We conducted this retrospective cross-sectional study using clinical data of individuals tested for SARS-CoV-2 infections by the University of Utah's academic healthcare system from March 10, 2020, to July 10, 2020. University of Utah Health, based in Salt Lake City, Utah, is an extensive healthcare network that oversees five regional hospitals and over 100 health centers and institutes, and 26 of these facilities interacted with COVID-19-positive individuals during the testing period.22 As a major referral center for the Intermountain West, University of Utah Health's patient population comprises Utah and non-Utah residents. University of Utah IRB approval was obtained prior to the start of this study. We extracted clinical and demographic data from the University of Utah Electronic Data Warehouse. The clinical data used in this study included SARS-CoV-2 testing unit location and results; indications of select comorbidities; an indication of mechanical ventilation; an indication of in-hospital death (measured up to July 10, 2020); a general patient classification (outpatient, inpatient, emergency, institutional series, etc.); and admission and discharge date and time. Additionally, demographic data included self-reported race, ethnicity, gender identity, and age.

COVID-19 Predictors

The primary predictors of COVID-19 severity explored in this study were race, ethnicity, gender identity, and age. We explored multiple race and ethnicity combinations using self-reported race and ethnicity responses. The most granular race and ethnicity combination had 8 distinct responses. We created a collapsed race and ethnicity combination using this granular combination for statistical modeling and to protect patient confidentiality, as some demographic categories had limited observations (Table 1).

COVID-19 Outcome

We developed a COVID-19 severity index using the information on admission and discharge units, length of stay, indications of ventilation, and indications of mortality. This severity index had 5 non-overlapping, independent levels. These levels, from least severe to most severe, were as follows: negative SARS-CoV-2 test, positive diagnostic test and outpatient care (outpatient), positive diagnostic test and emergency department (ED) care, positive diagnostic test and hospitalization (hospitalization), and positive diagnostic test and in-hospital mortality (death). A novel aspect of this severity index includes outpatient and ED care. Outcome categorization heavily relied on patterns in admission and discharge units and indications of ventilation and mortality. However, when these were unknown, illness severity assignment was made using responses in clinical variables. Individuals were sorted based on the highest level of care received. For example, individuals who were first tested in the ED and subsequently hospitalized were categorized as hospitalized. The individuals first tested in an outpatient

Table 1. Race and ethnicity combinations utilized in this study. Left – granular race and ethnicity combination. Right – combined race and ethnicity combination used in bivariable and multivariable analyses.

Original categories captured in the Electronic Health Record	Collapsed categories for data analysis
American Indian or Alaskan Native, Not Hispanic or Latino	American Indian or Alaskan Native, Not Hispanic or Latino
Asian, Not Hispanic or Latino	Person of Color, Not-Hispanic or Latino
Black or African American, Not Hispanic or Latino	
Native Hawaiian or Pacific Islander, Not Hispanic or Latino	
White, Not Hispanic or Latino	White, Not Hispanic or Latino
Person of color, Hispanic or Latino	Person of color, Hispanic or Latino
White, Hispanic or Latino	White, Hispanic or Latino
Unknown race or ethnicity	Unknown race or ethnicity

setting who later died while under hospital care were classified as in-hospital death, and so on.

Inclusion and Exclusion

Individuals who tested positive but did so while seeking care for another condition (e.g., pre-surgery testing) were removed from the sample, as our objective for this study was to evaluate COVID-19 severity among individuals seeking care due to the virus. Basic information on admission, disposition, or patient type was excluded from the analysis. It should be noted that all individuals who tested negative for the virus were included only in the descriptive analysis and were removed during inferential statistics. These individuals who tested negative were also removed during the length of stay analysis. Similarly, those who identified as non-binary or did not disclose their gender were removed from inferential analysis due to low frequency.

Statistical Methods

The associations between sociodemographic characteristics and COVID-19 illness severity were analyzed using standard cross-tabulation methods, with all categorical results reported in frequencies and percentages. Length of stay for all severity levels was characterized using medians, interquartile ranges, and ranges. We used multivariable logistic regression to generate odds ratios (95% CI) on associations between race, ethnicity, and gender and the likelihood of ED and inpatient hospitalization care. Reference categories for gender, age, and race and ethnicity were as follows: female, 18 to 25 years of age, and WNH. Model fit was assessed using Akaike Information Criterion (AIC). Adjusted multinomial logistic regression was employed to assess demographic predictors of COVID-19 death using the same reference categories for gender, age, and race and ethnicity. We report missing values for our predictors and outcomes. All models were a complete case analysis. We used Stata (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC) for all analyses.

Results

Characterization of Sample

Of the 70,913 tested for SARS-CoV-2 from March 10, 2020, to July 10, 2020, 6470 adults tested positive for SARS-CoV-2, and 6445 were eligible for this study. Of the 6445 individuals eligible for this study, race and ethnicity were known for 4829 (85.8%), gender identity was known for 6424 (83%), and age was known for all (100%). There were 25 deaths before discharge, leaving a sample of 6420 for the multivariable analyses. Just over half of the sample population identified as female (53.3%). 12.6 percent of the sample population was 65 years or older during testing. Finally, most individuals in this sample identified as WNH (61.0%) (Table 1).

An overall percent positivity of 9.1 percent was observed in this population between March 10, 2020, and July 10, 2020. Notably, all non-White individuals (23.1%) exhibited a proportionally higher percent positivity than WNH individuals (3.9%). Individuals who identified as female had a slightly lower percent positivity than those who identified as male (8.2%, 10.1%, respectively). Individuals who identified as non-binary

Table 2: Characteristics of the study population stratified by COVID-19 severity

	Total (n=70913)	percent	Negative (n = 64468)	Total positive (9.1%)	percent positive	Outpatient (n = 6075, 94.3%)		ED (n = 150, 2.3%)		Hospitalized (n = 195, 3.0%)		Death (n = 25, 0.4%)	
Race and Ethnicity													
White, Not-Hispanic or Latino	43234	61.0%	41543	1691	3.9%	1567	92.7%	45	2.7%	69	4.1%	10	0.6%
American Indian or Alaskan Native, Not-Hispanic or Latino	502	0.7%	463	39	7.8%	28	71.8%	<10	**	<10	**	<10	**
Asian, Not-Hispanic or Latino	1523	2.2%	1394	129	8.5%	117	90.7%	<10	**	<10	**	0	0.0%
Black or African American, Not-Hispanic or Latino	1241	1.8%	1038	203	16.4%	186	91.6%	<10	**	<10	**	0	0.0%
Native Hawaiian or Pacific Islander, Not-Hispanic or Latino	1144	1.6%	970	174	15.2%	158	90.8%	<10	**	<10	**	<10	**
White, Hispanic or Latino	3249	4.6%	2661	588	18.1%	554	94.2%	19	3.2%	**	**	<10	**
person of color, Hispanic or Latino	8673	12.2%	6668	2005	23.1%	1880	93.8%	48	2.4%	**	**	<10	**
Unknown or non-disclosed race and ethnicity	11347	16.0%	9731	1616	14.2%	1585	98.1%	12	0.7%	**	**	<10	**
Gender													
Female	37980	53.5%	34883	3097	8.2%	2906	93.8%	87	2.8%	**	**	<10	**
Male	32880	46.3%	29553	3327	10.1%	3146	94.6%	64	1.9%	**	**	**	**
Nonbinary or unknown*	136	0.2%	111	23	16.9%	23	100.0%	0	0.0%	0	0.0%	0	0.0%
Age													
18 - 24 years	10615	15.0%	9362	1253	11.8%	1218	97.2%	19	1.5%	**	**	<10	**
25 - 44 years	30822	43.4%	27829	2993	9.7%	2855	95.4%	75	2.5%	**	**	<10	**
45 - 64 years	20119	28.3%	18290	1829	9.1%	1699	92.9%	43	2.4%	**	**	<10	**
65 + years	8921	12.6%	8563	372	4.2%	301	80.9%	14	3.8%	39	10.5%	16	4.3%

* Combined due to low cell counts

** Suppressed for confidentiality

or did not disclose their gender had the highest percent positivity of the strata (16.9%) (Table 2).

Out of the 6445 individuals who tested positive for SARS-CoV-2, 6075 (94.3%) received outpatient care, 150 (2.3%) received care in the emergency department, 195 (3.0%) were hospitalized, and 25 (0.04%) individuals died in hospital (Table 3).

Length of stay in care by type of care for this study population was as follows: outpatient (median=13 hours, IQR=4 hours), emergency department (median=4 hours, IQR=7 hours), inpatient hospitalization (median=52 hours, IQR=98 hours), patients requiring ventilation (median=285 hours, IQR=671), and those patients who died in hospital (133 hours, IQR=186) (Table 4).

Compared to WNH, racial and ethnic minoritized groups had increased adjusted odds ratios (aOR) of receiving emergency department care or hospitalization (aOR =1.83 [95% CI: 1.09, 3.07]; aOR = 7.11 [95% CI: 2.90, 17.43], respectively) (Table 5). Compared to patients younger than 65 years, patients 65 years or older had increased odds of receiving emergency department care or hospitalization (aOR =2.94 [95% CI: 1.46

Table 3: Frequency and percent of sample population severity categorization (n=70915)

Severity index	n	Percent
Negative	64468	90.91%
Outpatient	6075	8.57%
ED	151	0.21%
Hospitalized	196	0.28%
Death	25	0.04%

Table 4: Distribution of length of stay in a care facility of COVID-19 patients in hours

Severity	n	Median	IQR	Max
Outpatient	6075	13	4	88
Emergency Department	151	4	7	18
Inpatient Hospitalization	175	52	98	1033
Ventilated	21	285	671	1309
Death	25	133	186	739

Table 5: Multivariable adjusted odds ratios for COVID-19 emergency department and inpatient hospitalization care

		Emergency Department		Inpatient hospitalization
Population Characteristics	**n**	**Odds Ratio (95% CI)**	**n**	**Odds Ratio (95% CI)**
Race and Ethnicity				
White, Non-Hispanic or Latino	45	Reference	69	Reference
American Indian or Alaskan Native, Non-Hispanic or Latino	<10	3.84 (1.21, 13.20	<10	7.11 (2.90, 17.43)
Person of color, Non-Hispanic or Latino	23	1.83 (1.09, 3.07)	21	1.24 (0.75 - 2.06)
White, Hispanic or Latino	19	1.20 (0.70, 2.10)	13	0.65 (0.35 - 1.19)
Person of color, Hispanic or Latino	48	0.91 (0.6, 1.38)	71	0.99 (0.70 - 1.40)
Unknown race and ethnicity	12	0.28 (0.15, 0.53)	14	0.23 (0.13, 0.42)
Gender				
Female	87	Reference	95	Reference
Male	64	0.72 (0.52, 1.00)	101	1.06 (0.80 - 1.46)
Age				
18 - 24 years	19	Reference	15	Reference
25 - 44 years	75	1.72 (1.03, 2.90)	62	1.82 (1.03 - 3.22)
45 - 66 years	43	1.7 (0.98, 2.93)	80	3.87 (2.21 - 6.78)
65+ years	14	2.94 (1.46, 5.96)	39	10.24 (5.53 - 18.97)

5.96]; aOR = 10.24 [95% CI: 5.53, 18.97], respectively). Compared to women, men had similar odds of receiving emergency department care or hospitalization (aOR = 0.72 [95% CI: 0.52, 1.0] and aOR = 1.06 [95% CI: 0.80, 1.46], respectively).

Discussion

In this study, we aimed to describe differences in COVID-19 outcome severity by race, ethnicity, gender identity, and age. We found that among the 9.1 percent (n = 6,420) of patients who tested positive for SARS-CoV-2 at University of Utah Health facilities from March to July of 2020, 95 percent received outpatient care, approximately 2 percent received care in the emergency department, 3 percent were hospitalized, and 0.4 percent died. Differences in COVID-19 illness severity could be partially explained by racial identity.

Individuals who identified as "American Indian or Alaskan Native, non-Hispanic or Latino," or "person of color, non-Hispanic or Latino" had higher odds of receiving ED care than WNH individuals. Similarly, "American Indian or Alaskan Native, non-Hispanic or

Latino" individuals had higher odds of being hospitalized than WNH individuals.

This study's results are generally in line with prior research reporting an increased level of COVID-19 illness severity in non-White individuals compared to persons of color.[23] Similarly, work utilizing the Coronavirus Disease 2019-Associated Hospitalization Surveillance Network (COVID-NET) found that the highest hospitalization, hospitalization in intensive care units (ICU), and death rates occurred among Hispanic or Latino individuals and Black or African American individuals.[16,24] Our results deviate slightly from previous work in that associations between being White, Hispanic or Latino, versus WNH, and COVID-19 illness severity were largely null.

Our null findings could be due to several reasons. First, it is possible that ethnic identity between these groups did not explain the likelihood of severe COVID-19 outcomes in this population during the pandemic. Second, immigration status in comorbidity burden may play a significant role in illness outcome but were not considered in this current work. Finally, we had limited power to detect differences within our early pandemic sample. Larger studies within Utah are needed before definitive conclusions can be made.

Individuals who did not disclose their race and ethnicity or were documented as being of an unknown race or unknown ethnicity had lower odds of receiving ED care or being hospitalized. This is not due to inherent protection inferred by non-disclosure of race and ethnicity but due to an evident reporting bias: it appears that patients are less likely to disclose their race and ethnicity when receiving care in the outpatient setting than patients who require higher levels of care (eg, ED or hospitalization). This also indicates individuals' lack of trust when seeking healthcare for non-critical situations.

Depending on social and biological determinants, disease experience and burden vary in different groups. The COVID-19 pandemic and associated diseases are no different and have highlighted and broadened persistent health disparities in the United States.[23, 25, 26] Racial and ethnic minoritized groups are more likely to reside and work in high transmission areas, have less access to testing and vaccination services, and present with a higher level of illness severity when seeking care. Additionally, racial and ethnic minoritized groups are, in general, more burdened by comorbidities that are strongly associated with severe COVID-19 outcomes.[27] Notably, previous work in Utah calls attention to the fact that many areas with high health disparities have proportionally larger racial and ethnic minoritized populations than areas with low health disparities.[27] This work suggests that there may be an association between compounded transmission and racial and ethnic minoritized individuals residing in Utah.[16,23,24]

Limitations and Strengths

This study is subject to 2 distinct limitations. First, this study only captures illness severity through the lens of clinical outcomes in patients who sought testing and treatment at 1 medical network during the pandemic's beginning. As such, these results may not be generalizable to all COVID-19 patient experiences across the pandemic, characterized by various surges of different SARS-CoV-2 lineages, dissemination of vaccines and treatments, and changes in public health response. Secondly, this study did not account for all structural and social determinants that have been identified as affecting health outcomes (socioeconomic status, insurance coverage, occupation, place of residence, level of educational attainment, etc.). Consequently, these results do not capture all variations in COVID-19 illness severity influenced by structural and social determinants.

However, this work has its strengths. First, we describe and characterize illness severity using a granular index. This is distinct, as most work early in the pandemic assessed illness severity using only 3 levels of severity rather than the 5 developed for this study. Secondly, this work captured information on race and ethnicity for 84 percent of individuals in the sample. This is notable as race and ethnicity are often under-reported in medical and public reports. Finally, while this work only focuses on the earliest stage of the COVID-19 pandemic, it sets a solid methodological foundation for future infectious disease studies in Utah using the Enterprise Data Warehouse, especially those designed to capture illness severity.

Conclusion

This retrospective descriptive analysis found that

COVID-19 illness severity, measured by an expanded illness severity index, varies by race, ethnicity, and age. In Utah, the likelihood of more significant illness severity outcomes disproportionately impacts older individuals and individuals identifying as "American Indian or Alaskan Native and non-Hispanic or Latino" or "person of color and non-Hispanic or Latino." Further work is needed to understand the complexities of the COVID-19 disease experience and how it has changed over time in Utah and throughout the Intermountain West. Specifically, an emphasis on structural and social determinants of COVID-19 illness, while controlling for biological determinants, across the entire pandemic is needed.

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Women in Post-Secondary Education: Utah Fails to Thrive

Elizabeth Turner
/ University of Utah

Problem Statement

This commentary will outline the education levels of women in Utah including trends, failures to progress, and confounding factors. Utah has one of the largest graduate degree gender gaps in the country.[1]

While the definition of education can be rather subjective, for the purposes of this commentary we will divide educational attainment among adults into the following categories: less than high school; high school graduate (includes equivalency); some college; Associate's degree; Bachelor's degree; and Graduate or Professional degree.[2]

In 2016 the percentage of students who attended public schools and graduated with a traditional diploma, 4 years after beginning the 9th grade, was 84.1% worldwide.[3] The Healthy People 2030 goals includes a desire to increase this level of education to 90.7%.[3] In Utah, 6.6% of women have earned less than a high school degree, 23.4% hold a high school or equivalent degree, 26.5% have completed some college, 10.8% hold an associate's degree, 23.5% have a bachelor's degree, and 9.3% have a graduate or professional degree.[2]

Status of Literature

Education has been strongly correlated with health status as those with higher levels of education often have higher income, improved mental health, a strong social support network, a lower risk of death later in life, and a deeper understanding of disease and preventative health habits.[2,3] Education is a prominent and crucial topic often discussed in many public health domains across the globe, including women's health.

According to the U.S. Census Bureau, national trends show women earn more bachelor's degrees than men, 20.6% to 19.8% respectively. Utah exceeds those numbers with 23.0% of women and 22.6% of men earning bachelor's degrees. Interestingly enough, Utah women fall behind when it comes to graduate and professional degrees. The percentage of women earning a graduate degree in the U.S. is about 13% but in Utah that percentage stands at 9.3%.[4]

Utah women are aggressively falling behind their counterparts across the country even though they highly desire graduate degrees.[5] According to a study conducted by Utah State University (USU), where 907 college enrolled women participated, nearly half of them indicated they planned to attend graduate school.[5] This leaves us with the burning question; why are only 9.3% of women in Utah actually achieving this goal?

Call to Action

It seems as though ambition or intention is not an issue for women in Utah so there must be other barriers influencing their ability to earn a graduate degree. According to USU, women enrolled in graduate degree programs in Utah are older, more ethnically diverse, likely to cohabitate or have a child, and struggle with managing family responsibilities while obtaining a higher education.[5]

Many companies discuss "work-life" balance and prioritize this mindset for their employees as burnout has

become a more prominent issue, particularly within healthcare fields as a result of the pandemic. However, this same mentality is not often discussed or prioritized for graduate students, who are more often than not, juggling careers, families, and attending graduate school full time.[5] This balancing act plays a major role in the percentage of women who hold graduate degrees in Utah. Undergraduates often do not face the same balancing act challenges of graduate students and this is reflected in the number of women who complete their degree programs, 23.5% and 9.3% respectively.[2]

There are many resources available to graduate school students including childcare, scholarships, fellowships, housing, transportation, healthcare, grants, and continued educational support.[6] We need to raise awareness and create paths to overcome the perceived barriers of attending and successfully completing graduate school. We must move forward, empower, and provide women in Utah with the resources they need to follow their ambition, achieve their academic goals, and close the graduate degree gender gap.

In Utah, the issue is not lack of resources but rather a failure by Utah academic institutions to adequately get the word out to potential undergraduate and graduate students on how and where to access these resources. Resources should be well advertised in application materials so that potential students can assess whether they will have the necessary resources to accomplish their goals prior to applying for a program or at the very least prior to deciding to enroll. Graduate students need continuous support in order to balance their academics, personal life, and careers effectively. While there is an immense amount of work to be accomplished on this topic, graduate school is not the only way we can improve health outcomes and increase life expectancy. Education should be a universal opportunity and all forms of education will increase the health and wellness of our communities.

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Reproductive Health Literacy Among Adolescent Women in Utah

Logan Waechtler
/ University of Utah

Problem Statement

The adolescent brain is not fully developed until at least 25 years of age.[1, 2, 3] This is especially apparent for the parts of the brain that control judgment and impulsiveness.[1] As this relates to reproductive health, inadequate reproductive health literacy is a concern for female adolescents ages 12–18 in Utah. If adolescents do not have knowledge about how the reproductive health system works, then they may be unlikely to identify signs of fertility and are at greater risk of an unintended pregnancy, which leads to other adverse social and health outcomes for the mother and child.[4]

Reproductive health literacy is an important aspect of the status of sexual education in Utah because the state limits sexual education to abstinence-only.[5] Ensuring adolescents have knowledge of reproductive health is part of all domains of health, including intellectual health. The more education a woman has, the more likely she can understand her reproductive health system, including her fertility. Curriculum changes that include more comprehensive sexual education, which incorporate fertility awareness-based methods (FABMs), are one approach to help adolescents understand hormonal fluctuations and cycle-related experiences as well as avoid unintended pregnancies. Having empowering knowledge on how the reproductive system works through charting with FABMs can help adolescents choose to engage in other activities during their fertile window that do not lead to sexual intercourse, or to choose other contraceptive measures that can prevent unintended pregnancies.

Status of Literature

Health literacy improves health outcomes across generations.[6,7] The Centers for Disease Control and Prevention (CDC) found that 40% of high school students across the U.S. engaged in sexual intercourse and 54% of those sexually active did not use a condom the previous time they had sex.[8] Healthy sexuality, free of shame and stigma, paired with information to make the best decisions for themselves and their partners, is an important goal. For instance, some studies have found that many high school students rely on information about sexual and reproductive health received from peers[9,10] and not what they learn from trained educators, which is insufficient. When adolescent women have low reproductive health literacy, they are at a higher risk for unintended pregnancy.[4]

Various studies have found that sexual and reproductive health education serves as a protective factor against adolescent pregnancies.[10,11,12] Furthermore, the American Association of Pediatrics (AAP), American College of Obstetricians and Gynecologists (ACOG), and American Academy of Family Physicians (AAFP) encourage pediatricians, schools, and parents to provide developmentally-appropriate and evidence-based education about human sexuality and reproduction to adolescents because it has been shown to reduce the risk of pregnancy.[13,14,15] The CDC also supports this approach to reducing pregnancy risk for adolescents by providing recommendations for schools about how they can deliver quality sexual health education, such as helping students to take responsibility to improve their health outcomes.[16] However, Utah's current state of sexual education focuses on the benefits of abstinence and prohibits discussions around any form of

contraception.[5]

In Utah, 85% of schools report abstinence as a topic in their sexual education programs.[8] In contrast to the U.S. as a whole, other topics of discussion where Utah falls short include the importance of correct and consistent condom usage, the efficacy of condoms, and methods of contraception other than condoms.[8] Only 0–23% of Utah schools discuss these topics, compared to 27–45% of schools across the U.S.[8] It can be argued that the topics allowed in Utah's sexual education curriculum influence the outcomes of the pregnancy rate for female adolescents. Although Utah's adolescent pregnancy rate for women ages 15–19 was 9.2% in 2021, this figure is lower than the U.S. average of 13.9%.[17]

Currently, Utah has two programs tailored to adolescent populations (ages 10-19) in the juvenile justice and foster care systems: the Sexual Risk Avoidance Education program and the Personal Responsibility Education program. Both are intended to educate adolescents on abstinence and contraception.[17,18] Including FABMs in the full range of contraceptive options is warranted, as they help increase understanding about menstrual cycle parameters, fertility, and hormonal fluctuations that may influence individuals' lived experiences. They are also an alternative for preventing pregnancy when users receive adequate training.[19]

Research on the inclusion of FABMs in reproductive health education for adolescents and their impact on adolescent behavior is limited. A 2005 study showed that adolescents enrolled in the Teen STAR program were about 9% less likely to initiate sexual behavior compared to those who were in the control group.[20] While this study was more than 15 years ago, Teen STAR continues to offer educational programs to teenagers based in the science of the Billings Ovulation Method, an FABM that requires users of the method to track daily cervical mucus sensations to identify their window of fertility each menstrual cycle.[21]

Call to Action

One way to enhance adolescent knowledge of reproductive health, so that they can feel empowered, is via FABMs, which are a natural way to understand one's own menstrual cycle, alternations in hormones, and fertile window. Adolescents can find information about these methods through organizations like FACTS About Fertility, which regularly provides a low-cost webinar for teenagers to learn the basics of charting their cycles using a FABM. However, at this time, more research on Teen STAR in addition to other FABMs targeted at adolescents such as TeenFEMM are needed regarding the effectiveness in avoiding unwanted pregnancies before rolling out in reproductive health education programs, including programs in Utah. Incorporating FABMs in school-based health education policy at the state and local level through existing programs and guiding adolescents to implement FABMs into practice has the potential to enhance reproductive health literacy of Utah's adolescents.

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Menstrual Cycle's Effect on Women's Intellectual Health

Lauren Spackman & Arlyne Arteaga
/ University of Utah

Problem Statement

Menstruation affects girls and women starting as young as ten years old and can involve various aspects of a girl's life. Some of the most common symptoms of the menstrual cycle are bloating, bleeding, mood swings, feeling irritable, and more.[1] These symptoms vary in intensity and frequency; no two periods are the same. The average period happens once a month, and lasts for about 7 days.[1] The menstrual cycle is something female bodies naturally adapt to, but depending on severity, it can affect many aspects of an individual's life. Specifically, those who menstruate are more likely to have their school performance affected due to shame and stigma, lack of period products, hormones affecting one's concentration, and more.

Status of Literature

Missing school due to menstruation is something that can have a significant impact on the intellectual health of women and girls. For example, in a study given to teachers, researchers found that "teachers perceived the menstrual cycle to affect Physical Education (88%), pupil confidence (88%), school attendance (82%) and attitude and behavior (82%). Teachers also perceived the menstrual cycle to influence multiple aspects of school attendance and personal performance".[2] In addition, another study in Africa showed that "one in ten girls missed school while on their period, and that 50 percent of girls miss between 1 and 4 days of school every month due to menstruation".[3] It is common for schools to lack proper supplies for menstruation nor offer any female hygiene products at all.

However, some efforts have been put in place to raise awareness for how menstruation affects women and girls. Specifically, the "Menstrual Hygiene Day" was launched to raise awareness about the need for adequate and sufficient menstrual hygiene management for adolescent girls in schools and beyond. The efforts of these awareness campaigns is to advocate for and break taboos and stigma surrounding menstruation.[3] Schools around the United States have started programs to offer feminine hygiene products in bathrooms, so students do not miss school due to a lack of supplies. Unfortunately, women and girls who live in poverty are affected by lack of menstrual products at a much higher rate. Although availability of menstruation products in girls bathrooms is now an option, this does not mean they are always free. The United States is a high-income country where low-income folks struggle to meet their needs; however, only 17 states in the U.S. have passed laws that require schools to give access to period products for free, leaving 33 states vulnerable.[4]

Feminine hygiene products contribute to a significant component of how menstrual cycles negatively impact women's intellectual health. A study on female college students found that 14.2% of women in the sample size had experienced period poverty in the last year, with 10% experiencing it each month.[5] This study also analyzed the correlation between period poverty and women's mental health. Results showed that women who experienced period poverty every month showed the most severe symptoms of depression.[5] Mental health and intellectual health have a strong correlation because it can affect one's motivation, productivity, and focus.

Unfortunately, period poverty is also a global crisis. For example, in Tanzania, period poverty is the single largest barrier to young girls completing their education.[6] In Tanzania, many young women cannot afford disposable pads. In efforts to replace pads and tampons, women have used cow dung, mattresses, and feathers to stop their bleeding.[7] In addition, the schools do not offer safe places for women to change their disposable pads or provide alternatives to home learning.[6] In effect, these young women stay home due to deep shame, mental health struggles, and health risks from using unsanitary menstruation products. It's no surprise that the young girls in Tanzania fall behind in their schoolwork, for a period does not stop after only one month.

Call to Action

Understanding and spreading awareness about menstruation can help increase ways for women and girls to be supported intellectually. Additionally, learning about varying menstruation experiences can allow for openings to new outcomes. For example, a study conducted by Boyle and colleagues looked at the positive effects of menstruation on academic performance. Specifically, Boyle found that "although most significant relationships were negative between menstruation and academic performance, scores positively predicted grades in English, Math, Art, History, and Study of Society".[8] This study showed menstruation to have a positive impact on academic performance rather than negative. Although there is an overall lack of studies on how menstruation positively impacts women's intellectual health, this study serves as a call to action. It is crucial to continue looking at the correlations between menstruation and intellectual health. By understanding how periods affect female bodies in both negative and positive ways, new systems can be presented to better support women academically.

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Do Interventions Targeting Women Impact Children's Health Behaviors?

McKenzie Nava[1], Kaila Christini[2], Deanna Kepka[1,2], Jacqueline Kent-Marvick[1], Kathleen B. Digre[3,4], Louisa A. Stark[5], France A. Davis[6], Doriena Lee[6], Valentine Mukundente[7], Eruera "Ed" Napia[8], Ana Sanchez-Birkhead[1,9], O. Fahina Tavake-Pasi[10], Jeannette Villalta[9], Heather Brown[5], & Sara Simonsen[1]

/ [1]College of Nursing, University of Utah; [2]Huntsman Cancer Institute, University of Utah; [3]Department of Neurology, and Ophthalmology & Visual Sciences, University of Utah; [4]Department of Obstetrics and Gynecology, University of Utah; [5]Community Collaboration & Engagement Team, University of Utah; [6]Calvary Baptist Church; [7]Best of Africa Group; 8UAI/AN Community Leader; [9]Hispanic Health Care Task Force; [10]National Tongan American Society

Abstract

Objectives: Women play an important role in promoting healthy eating and physical activity within their households, influencing the current and life-long health behaviors of children. The purpose of this study is to describe changes in fruit/vegetable consumption and physical activity among children living with racially and ethnically diverse women participating in a lifestyle-change intervention.

Methods: The study involves secondary analysis of data from a randomized trial of a wellness-coaching intervention led by Community Health Workers, called Community Wellness Coaches in this study. Study participants came from five diverse racial/ethnic communities. Participants received monthly vs. quarterly wellness coaching. Data on changes in the health behaviors of children at four months after enrollment were collected through interviews. Children's behavior changes were compared by study arm, demographics, and women's health behaviors.

Results: Overall, 71.9% of women reported increases in the fruit/vegetable intake of children living in their household and 59.4% reported increases in children's physical activity. There were no differences in children's fruit/vegetable intake or physical activity by study arm (p=0.88). Women who reported that their own fruit/vegetable intake increased were more likely to report an increase in children's consumption (aOR=2.55, 95%CI 1.05 - 6.21).

Conclusion and Implications: Among women of color participating in a health-behavior change intervention, women's behavior changes were associated with improvements in child health behaviors. Interventions focused on improving women's health behaviors may also impact the behaviors of children and other household members. Emphasizing the role of women on the health of children in such interventions may magnify this impact.

Introduction

The U.S has experienced nearly a two-fold increase in obesity in less than 30 years.[1] Disparities in obesity rates exist among women from different racial/ethnic groups. For example, Utah data from 2021 reveal overweight/obesity rates of 39.2% (95% CI 32.5 - 46.3) among people of Asian descent, 62.8% (95% CI 54.5 - 70.5) among Black people, 64.2% (95% CI 63.3 - 65.1) among white people, 71% (95% CI 66.9 - 74.7) among people of Hispanic/Latinx descent, 74.9% (95% CI 68.8 - 80.2) among people of American Indian/Alaska Native descent, and 87.9% (95% CI 78.9 - 93.4) among people of Native Hawaiian/Pacific Islander descent.[2] These rates differ slightly when compared to national data from 2021, although data indicate national disparities by race and ethnicity, with overweight/obesity rates of 14.5% (95% CI 11.4 - 18.1) among women of Asian descent, 39.6% (95% CI 36.2 - 43.0) among white non-Hispanic/Latinx women, 45.7% (95% CI 42.4 - 49.1) among women of Hispanic/Latinx descent, and 57.9% (95% CI 54.0 - 61.7) among Black women.[3] When a child has a parent who is obese, a child is three times more likely to be overweight or obese.[4] Thus, identifying novel and effective ways to address and prevent obesity in both mothers and their children is critical. Educational interventions that are delivered to mothers and impact their children have the potential

to address childhood obesity.

Given the racial/ethnic disparities in obesity rates among women and children, the Coalition for a Healthier Community for Utah Women and Girls (UWAG) conducted a randomized trial of a 12-month wellness-coaching intervention for women of color [Hispanic/Latinx, American Indian/Alaska Native, African American, African Refugees/Immigrants, and Native Hawaiian/Pacific Islander] residing in Utah. The aim of the present secondary analysis using baseline and four-month data was to better understand whether wellness coaching focused on fruit/vegetable intake (FVI) and physical activity among these women was associated with changes in the health behaviors of children living in their homes. This research question is important because obesity is on the rise for both adults and children. Communities of color are also disproportionately impacted by high overweight and obesity rates, due to social determinants of health, such as disparities in food access (e.g., readily available highly processed and energy-dense foods and fewer low-cost, fresh foods), neighborhood environment resources, and lack of health-insurance coverage.[5]

Methods

The UWAG study was developed through a partnership between the Utah Women's Health Coalition (UWHC) and Community Faces of Utah (CFU). CFU is an established partnership that includes leaders from five different community organizations along with University of Utah and Utah Department of Health personnel. The communities include African immigrants and refugees from Burundi, Central African Republic, Democratic Republic of Congo, and Rwanda, African Americans, American Indian/Alaska Natives, Hispanic/Latinx, and Native Hawaiian/Pacific Islanders. Community-based participatory research (CBPR) best practices were employed to build trust between community leaders and academic researchers.[6] The process began with the leaders identifying the priority health issues for the intervention—diabetes and obesity—and the focus on increasing healthy diet and exercise behaviors.[7] The UWAG partnership involved the community leaders and academic partners as research collaborators throughout all phases of the study, including planning, design, implementation, data analysis, and dissemination of study findings.[7]

Women from each of the CFU communities were trained to serve as Community Wellness Coaches (CWCs), helping to address issues related to obesity and diabetes by promoting healthy eating and exercise among women in their own communities. The CWCs understood the culture and context of their communities and thus were well suited to help women make healthy behavior changes.

The CWCs were also trained to collect height and weight, and to use a set of computer-assisted interview and coaching tools developed in Research Electronic Data Capture (REDCap) software.[8, 9] REDCap is an application for building, collecting, and managing online surveys and data hosted by the University of Utah through the Center for Clinical and Translational Science (recently renamed the Clinical and Translational Science Institute). Height was measured in inches using a measuring tape. While resting against the measurement surface, participants were instructed to look straight ahead, to relax their shoulders with arms resting at their sides and legs straight with knees close together and bare feet flat and almost together. Height was recorded to the quarter-inch at the beginning of the study. Weight was measured in pounds using an analog scale that was zeroed before each use. Participants were instructed to remove their shoes and to wear light clothing. Weight was recorded to the whole pound, and was taken at baseline, and once at each of the three follow-up time points. While published protocols were not used for these measurements, best practices were used based on the clinical expertise of our team, which included a nurse midwife and a physician. BMI was calculated by multiplying by 703 the result of weight in pounds divided by height squared {i.e., BMI = [weight in pounds / (height in inches x height in inches) * 703]}. For all racial/ethnic categories except Native Hawaiian/Pacific Islanders, BMI categories were: underweight <18.5, normal weight 18.5-24.9, overweight 25-29.9, obese 30 or greater.[10] BMI categories used for Native Hawaiian/Pacific Islanders were: normal weight <26, overweight 26-31.9, obese 32 or greater.[11] The interview questions were developed and adapted with input from CWCs and in collaboration with community partners to ensure cultural appropriateness and clarity. In addition to demographic questions, women were asked about their health knowledge and health behaviors, as well as

barriers and facilitators they perceived to their health behaviors. After all baseline information was gathered, participants were randomized to receive quarterly wellness coaching (low-intensity intervention arm) or monthly wellness coaching with monthly group activities (high-intensity intervention arm). The CWCs planned monthly activities based on the interests and needs of participants. Examples of these activities included grocery-store tours, healthy-cooking classes, group participation in 5K races, group hikes, bowling, and stress-management activities. Participants received tools related to these activities, such as measuring cups, exercise bands, recipes, and pedometers. Participants in both the low-intensity and high-intensity intervention arms were asked the same set of questions four months after randomization. At this follow-up interview, participants were asked to report changes in their diet and exercise behaviors as well as changes that they had observed in their children, spouse, and any other people living in the home during the prior four months. Data for analyses described in this paper came from baseline and four-month computer assisted participant interviews led by CWCs.

Questions on diet came from the Behavioral Risk Factor Surveillance System survey.[12] Participants were asked by a CWC about the number of times they drank pure fruit juice in the past month, ate fruit (including fresh, frozen, or canned fruit juice and fruit), and ate vegetables (including beans, dark green vegetables, orange vegetables, and "other" vegetables). To acquire accurate comparable answers on servings of fruits and vegetables, CWCs showed women images of serving sizes compared to familiar items such as dice and playing cards next to the actual item. CWCs also provided physical versions of these items to women to hold as they answered the questions. Physical activity was assessed using the following question: "In an average week, how much time do you spend being physically active or doing exercise?" The answer category options available for describing the weekly amount of physical activity time were: none, less than 20 minutes, 20-29 minutes, 30-59 minutes, 1 hour to less than 1.5 hours, 2 to less than 2.5 hours, 2.5 to less than 3 hours, and 3 or more hours. The level used in the data analysis for achieving recommended physical activity was 150 minutes per week, and the change in daily physical activity from baseline to follow-up was described as increasing more than one level or as not increasing.

Statistical and Data Analysis

The goal of these secondary analyses was to explore whether participants reported changes in the health behaviors of their children between the baseline and the four-month interview. We created Directed Acyclic Graphs (DAGs) of the hypothesized relationships between maternal and child changes in fruit and vegetable consumption and physical activity, in order to visually encode: 1) assumptions; 2) a priori knowledge; and 3) identification of the minimally sufficient set of covariates needed for confounding control. DAGs were created using the browser-based Daggity.net.[13] The DAGs provide a visual representation of the relationships among a complex system of interacting components (i.e., variables) and our assumptions about those relationships, in a mathematically grounded framework of non-parametric structural equation models, enabling a fuller understanding by a broader audience.[14-16] See Figures 1 and 2.

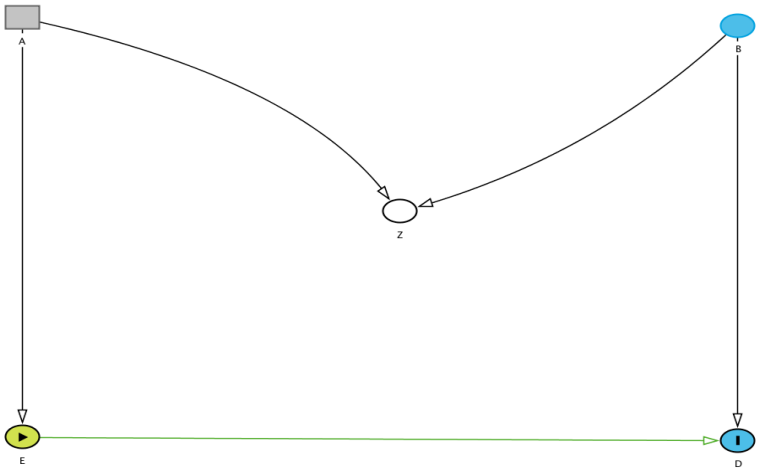

Figure 1. Directed acyclic graph (DAG) of the effect of mother's change in consumption on children's consumption of fruit and vegetables. Figure depicts encoding of the data generating mechanism and relationship between maternal diet and the diet of their children used in modeling and analysis. Daggity (http://dagitty.net/dags.html) and MS Visio used to create the DAG.

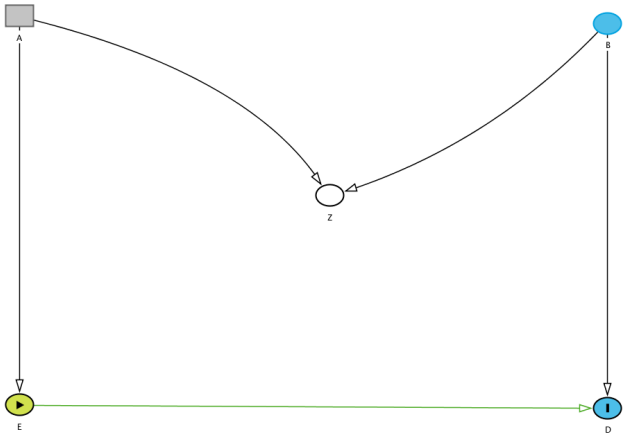

Figure 2. Directed acyclic graph (DAG) of the effect of mother's change on children's change in physical activity. Figure depicts encoding of the data generating mechanism and relationship between maternal physical activity and the physical activity of their children used in modeling and analysis. Daggity (http://dagitty.net/dags.html) and MS Visio used to create the DAG.

Key variables were compared between women reporting an increase or no increase in the FVI or physical-activity behaviors of children in the home and were tested using Fisher's exact 2-sided test. We explored whether demographics, health behaviors, or knowledge about diet/exercise were associated with children's health-behavior changes. Paired T-tests were used to examine differences in the mother's mean fruit and vegetable consumption and mean physical activity between baseline and follow-up. The association between women's age and children's increases in FVI and physical activity were assessed using pooled (equal variance) 2-sided t-tests as indicated by Folded F-Test (p=0.55, p=0.85, respectively).

Odds of reporting an increase in children's FVI and physical activity at follow-up were compared to reporting no increase at follow-up and were calculated using Firth's penalized-likelihood logistic regression in SAS software.[17, 18] Sensitivity of the effect estimates were also examined between the non-pregnant study population and the total study population, and effect-measure modification (EMM) was assessed, using the full-regression model, for any covariate in either population with an interaction term chi-square p-value≤0.10. The data were analyzed using IBM SPSS Statistics for Windows, Version 21.0. and SAS 9.4 software; copyright © 2016 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA. Research ethics approval was obtained from the University of Utah Institutional Review Board and the Phoenix Area Indian Health Service Institutional Review Board prior to implementing the study (IRB 00055195).

Results

The study involved 485 Utah women from African American, African, American Indian/Alaska Native, Hispanic/Latinx, and Native Hawaiian/Pacific Islander communities living in households across the Wasatch front that included a total of 2,499 individuals. Participants were excluded from this analysis if they did not have four-month data or had no children living in their home at baseline. Of the 485 women in the study, 53.2% of them (n=258) had children under the age of 18 in the home at baseline. A total of 224 women had both children in the home and four-month follow-up data and thus were included in this analysis. These women had a total of n=607 children living in their homes. Demographic data are shown in Table 1.

At baseline, participants had a mean age of 40.0 years (SD=9.6) and nearly 60% were living below the federal poverty line. Overall, the women had an average of 2.7 (SD=1.4) children per household with variation across communities (data not shown). Approximately 90% of these women were either sedentary or not meeting guidelines for recommended weekly exercise at baseline and almost 70% were not meeting guidelines for fruits/vegetables per day at baseline. Notably, 81.7% of women were overweight/obese at baseline; four months after randomization, 16.1% of the participants experienced a 5% or greater weight loss from their baseline weight, and only 12.0% experienced weight gain of 5% or greater (data not shown). When stratified, 5.2% (n=3) of women reporting an increase in fruit and vegetable consumption for their children, also experienced weight gain of 5% or greater; 10.2%

(n=12) of women reporting an increase in the physical activity of their child(ren), also experienced weight gain of 5% or greater, which did not differ significantly from women that did not experience weight gain during the study (p>.30) (data not shown).

As shown in Table 2 and Table 3, similar findings were observed among participants randomized to high-intensity and low-intensity study arms in the participant-reported changes in FVI among children at four months. There was a statistically significant difference in children's behavior changes by women's dietary behaviors, with 45.3% of women reporting that their own FVI increased, also reporting an increase in child consumption (aOR=2.55, 95%CI 1.05 - 6.21) in the minimally adjusted model. Fewer women who felt that preparation of fruits and vegetables was too time-consuming reported positive dietary changes in children. In fact, 94.4% of women who disagreed that "fruits and vegetables take too much time to prepare" reported increases in children's consumption compared to only 5.6% of women who agreed/strongly agreed that preparation of fruits/vegetables was time-consuming (aOR=2.20, 95%CI 0.70 - 6.57). While we observed participant-reported increases in the FVI of children across all groups, Hispanic/Latinx women were the most likely group to report an increase in children's consumption of fruit and vegetables, at 40.4%; and American Indian/Alaska Native women were the least likely to report an increase in their children's fruit and vegetable intake, at 10.6% (cOR=0.40, 95%CI 0.16 - 0.97).

The proportion of participants reporting increases in physical activity among children was similar between those randomized to the high- and low-intensity arms of the study (p=0.88), as described in Table 3. We observed differences in the changes in children's physical activity by a woman's own physical-activity level. Although not statistically significant, if the woman's physical activity had increased at four months by more than one category level, she had 1.60 times the odds of also reporting an increase in children's physical activity (aOR, 95%CI 0.89 - 2.94). Women who had a baseline BMI considered

Table 1. Demographics of Study Participants with Children in the Home *and* 4-Month Data

	n=224	(%)
Age (Mean, SD)	40.0	(9.6)
Number of Children		
1-2 Children	110	(49.1)
3 or More Children	114	(50.9)
Number of Children (Mean, SD)	5.1	(1.9)
Fast Food per Week		
Less Than Once per Week	126	(56.3)
Greater Than or Equal to Once per Week	98	(43.8)
Baseline BMI		
Underweight/Normal	41	(18.3)
Overweight	54	(24.1)
Obese	129	(57.6)
Baseline Daily Fruit/Vegetable Servings		
Less Than 5	154	(68.8)
5 or More	70	(31.3)
Mean Daily Baseline Fruit/Vegetable	4.3	(3.3)
Baseline Exercise		
Meeting Guidelines	23	(10.3)
Not Meeting Guidelines	201	(89.7)
Baseline Knowledge (Recommended Fruit/Vegetable Servings)		
Correctly Answered 5 or More	89	(39.7)
Incorrectly Answered Less Than 5	135	(60.3)
Baseline Knowledge (How often should you exercise?)		
Correctly Answered 150 minutes per Week or Greater	114	(50.9)
Incorrectly Answered less Than 150 Minutes per Week	110	(49.1)
Living Below the Federal Poverty Line[1]	122	(57.5)
Women Reports any Food Insecurity in the Past 30 Days[2]	91	(42.3)
Self-Reported Health Status at Baseline[3]		
Good to Excellent	118	(53.6)
Fair to Poor	102	(46.4)
How Often do you Make Healthy Choices About Diet or Physical Activity Because you Want to be Healthy for Your Children?		
Usually or Always	139	(62.1)
Sometimes to Never	85	(37.9)
4 Month BMI		
Underweight/Normal	42	(18.8)
Overweight	52	(23.2)
Obese	130	(58.0)
4 Month Daily Fruit/Vegetable Servings		
Less Than 5	134	(59.8)
5 or More	90	(40.2)
Mean 4 Month Daily Fruit/Vegetable	5.2	(3.4)
Exercise at 4 Months[4]		

Table 1. Demographics of Study Participants with Children in the Home *and* 4-Month Data

	n=224	(%)
Meeting Guidelines	22	(9.9)
Not Meeting Guidelines	201	(90.1)
Self-Reported Health Status at 4 Months[4]		
Good to Excellent	114	(51.1)
Fair to Poor	109	(48.9)

[1]Missing n=12, percent shown among non-missing responses (n=212)
[2]Missing n=9, percent shown among non-missing responses (n=215)
[3]Missing n=4
[4]Missing n=1

normal or underweight had 2.48 times the adjusted odds (95%CI 1.08 – 6.09) of reporting an increase in physical activity for children at follow-up. While not statistically significant, differences were observed in the proportion of women reporting increases in physical activity in children based on their own self-reported physical activity and environmental barriers to physical activity. We observed lower numbers of women reporting increases in the physical activity of their children who also reported not having a safe place (93.2% vs 6.8%, p=.16), and/or too much pollution and/or noise to exercise (83.5% vs 16.5%, p=.44). Similarly, women who expressed a belief that exercise is important had 1.38 times the odds (95%CI 0.64 – 2.95) of also reporting an increase in physical activity at four months for their children. Among racial/ethnic groups, Hispanic/Latinx mothers reported increases in their children's physical activity at a higher frequency (40.6%) compared to all other racial/ethnic groups (p=.27).

To examine the impact of pregnancy, we conducted a sensitivity analysis limiting the data analysis to women who were not pregnant at baseline and who were not pregnant at four-month follow-up (n=204, data not shown). We observed changes in excess of 10% of the reported effect estimates (aORs) from the minimally sufficient regression models in 64% of the estimates reported in Table 2 (fruit and vegetable consumption of children) and in 39% of the estimates reported in Table 3 (physical activity of children). The only estimate observed to cross the threshold for statistical significance (α=0.95) in the non-pregnant population was the odds of reporting an increase in fruit and vegetable consumption among women who reported being encouraged by their children to do healthy things a few times a week, compared to only being encouraged yearly or never. This estimate differed between the entire study population of women (aOR=2.57, 95%CI 0.99 – 6.62) and the non-pregnant women (aOR=3.51, 95%CI 1.28 – 9.76) in the study population.

Table 2. Odds of Maternally-Reported Changes in the Fruit and Vegetable Intake of Children[1]

	Total (N=224)	Child Increased Intake (n=161)	P-Value[2]	Unadjusted (Crude) OR[1]		Fully Adjusted Model OR[1,3]		Minimally Adjusted Model OR[1,4]	
	n	n (%)		cOR	95% CI	aOR	95% CI	aOR	95% CI
Mother's Age (Mean, SD)	(40.1, 9.6)	(39.5, 9.8)	.16	--	--	--	--	--	--
Mother's Age			.35	--	--	--	--	--	--
18-34	69	52 (32.3)		1.68	(0.79 - 3.60)	**2.81**	**(1.15 - 7.15)**	--	--
35-44	96	71 (44.1)		1.57	(0.78 - 3.14)	1.31	(0.59 - 2.89)	--	--
45-69	59	38 (23.6)		ref	--	ref	--	--	--
Race and Ethnicity			.12						
African American	55	35 (21.7)		1.22	(0.41 - 4.30)	1.60	(0.47 - 6.39)	--	--
African Immigrant/Refugee	23	19 (11.8)		0.49	(0.23 - 1.03)	0.51	(0.20 - 1.29)	--	--
Hispanic/Latinx	83	65 (40.4)		ref	--	ref	--	--	--
Native Hawaiian/Pacific Islander	34	25 (15.5)		0.76	(0.31 - 1.93)	0.54	(0.19 - 1.58)	--	--
American Indian	29	17 (10.6)		0.40	(0.16 - 0.97)	**0.36**	**(0.13 - 0.97)**	--	--
Intensity of Study Arm			.88						
High Intensity	126	90 (55.9)		0.95	(0.53 - 1.71)	1.08	(0.57 - 2.07)	1.10	(0.59 - 2.06)
Low Intensity	98	71 (44.1)		ref	--	ref	--	ref	--
Number of Children in Household			.14						
1-2 Children	110	74 (46.0)		ref	--	ref	--	ref	--
3 or More Children	114	87 (54.0)		1.56	(0.87 - 2.81)	1.60	(0.81 - 3.20)	1.51	(0.80 - 2.87)
Family in Poverty at 4 Months			.91						
Income Less Than 100% Federal Poverty Level	115	85 (53.8)		ref	--	ref	--	ref	--
Income 100-129% Federal Poverty Level	35	25 (15.8)		0.87	(0.39 - 2.05)	0.93	(0.38 - 2.38)	0.95	(0.41 - 2.34)
Income 130% or Higher Federal Poverty Level	67	48 (30.4)		0.89	(0.46 - 1.75)	1.07	(0.50 - 2.35)	0.99	(0.48 - 2.08)
Food Insecurity (in the Past 30 Days) at Follow-Up			.75						
0 Days in the Last 30 Days	152	108 (67.5)		ref	--	ref	--	ref	--
Any Amount of Days in the Last 30 Days	70	52 (32.5)		1.16	(0.62 - 2.23)	1.11	(0.55 - 2.29)	1.15	(0.59 - 2.31)
Self-Rated Health at Baseline			**.02**						
Fair/Poor	118	93 (58.5)		**2.01**	**(1.11 - 3.68)**	--	--	--	--
Good, Very Good, Excellent	102	66 (41.5)		ref	--	--	--	--	--

Table 2. Odds of Maternally-Reported Changes in the Fruit and Vegetable Intake of Children[1]

	Total (N=224)	Child Increased Intake (n=161)	P-Value[2]	Unadjusted (Crude) OR[1]		Fully Adjusted Model OR[1,3]		Minimally Adjusted Model OR[1,4]	
	n	n (%)		cOR	95% CI	aOR	95% CI	aOR	95% CI
Mother Experienced a Weight Loss of ≥5% at 4 Months			.13						
Yes	31	26 (16.1)		2.08	(0.85 - 6.07)	--	--	--	--
No	193	135 (83.9)		ref	--	--	--	--	--
Fast Food per Week			.30						
Less Than Once per Week	126	87 (54.0)		ref	--	ref	--	ref	--
Greater Than or Equal to Once per Week	98	74 (46.0)		1.37	(0.76 - 2.50)	1.40	(0.63 - 3.14)	1.53	(0.81 - 2.96)
4 Month Fruit/Vegetable Servings			.13						
Less Than 5	134	91 (56.5)		ref	--	--	--	--	--
5 or More	90	70 (43.5)		1.64	(0.90 - 3.05)	--	--	--	--
Baseline Daily Fruit/Vegetable Consumption (Mean; SD)[5]	224	(4.3; 3.3)		--	--	--	--	--	--
Follow-Up (4 Month) Daily Fruit/Vegetable Consumption (Mean; SD)[5]	224	(5.2; 3.4)	**<.01**	--	--	--	--	--	--
Change Daily in Fruit/Vegetable Consumption[5]			**.02**						
Daily FV Increased >1	90	73 (45.3)		**2.97**	**(1.27 - 7.01)**	**2.92**	**(1.16 - 7.44)**	**2.55**	**(1.05 - 6.21)**
Daily FV No Change	100	68 (42.2)		1.49	(0.67 - 3.28)	1.71	(0.72 - 4.07)	1.46	(0.63 - 3.32)
Daily FV Decreased <-1	34	20 (12.4)		ref	--	ref	--	ref	--
Preparation of Fruit and Vegetables Take too Long			.37						
Agree	15	9 (5.6)		ref	--	ref	--	ref	--
Neutral/Disagree/NA/Don't Know	209	152 (94.4)		1.82	(0.61 - 5.10)	1.98	(0.62 - 6.09)	2.20	(0.70 - 6.57)
Woman Agrees that Fruit and Vegetables Cost too Much			>.99						
Agree	86	62 (38.5)		ref	--	--	--	--	--
Neutral/Disagree/NA/Don't Know	138	99 (61.5)		0.99	(0.54 - 1.78)	--	--	--	--
How Often do you Make Healthy Choices About Diet or Physical Activity Because you Want to be Healthy for Your Children? (Follow-Up)			.29						
Usually or Always	172	127 (78.9)		1.50	(0.77 - 2.88)	--	--	--	--
Sometimes/ Rarely/ Never	52	34 (21.1)		ref	--	--	--	--	--
How Often do Your Children Encourage you to do Healthy Things Such as Eating Right, Exercising or Quitting Smoking? (Follow-Up)			**.10**						
Every Day	91	71 (45.2)		**2.55**	**(1.07 - 6.01)**	**3.20**	**(1.23 - 8.49)**	**1.85**	**(0.76 - 4.47)**
A few Times a Week	97	68 (43.3)		1.70	(0.74 - 3.86)	**2.56**	**(0.99 - 6.74)**	2.36	(0.97 - 5.74)
Yearly - Never	31	18 (11.5)		ref	--	ref	--	ref	--

[1]Odds of reporting an increase in child's/children's fruit/vegetable intake compared to no increase in intake.

[2]Fisher's exact 2-side P-value reported. Means of mother's age compared, as reported increased fruit/vegetable intake among children versus children who did not increase intake, using pooled (equal variance) 2-sided t-test as indicated by Folded F Test (P=0.55).

[3]Fully adjusted includes all covariates included on the DAG on biasing pathways (Kid FV = Mom FV + Age + Race/Ethnicity + Study Arm + No of children + Income + Food Insecurity + Fast Food + Food Prep Time + Kids Encourage).

[4]Minimally sufficient set for estimating the direct and/or total effect as indicated by the DAG included: Attitude of food preparation time, Fast food consumption, Food insecurity, Income, Kids encourage moms, No. of children, and Study arm.

[5]Mother's change in daily fruit/vegetable consumption calculated from reported weekly intake at baseline and follow-up. P-value from paired t-test comparing mean consumption between baseline and follow-up. An increased daily consumption change category indicates a difference between baseline and follow-up >1. Means and standard deviation reported for all participants. Difference in daily consumption between baseline and follow-up (range, mean, std.): -16.8 - 19.2, 0.9, 3.8 (P<.01).

We examined interaction in both the total and the non-pregnant study populations using the full-regression models and observed p-values ≥ 0.14 for all interaction terms in the fruit and vegetable consumption models. In the physical activity full models, we found evidence of interaction by BMI categories among the non-pregnant population (p≤.05), and weak evidence among the total study population (p≤.10). We also observed weak evidence of interaction by race and ethnicity in the non-pregnant study population (p≥.08), but not in the full study population (p≥.32). In further examining the interaction between BMI and women reporting increased physical activity at follow-up for children in their households, we observed BMI stratum-specific crude ORs that varied (39% change) between strata (with mostly overlapping 95% CIs), and that differed from the overall crude OR, suggesting the presence of confounding and effect measure modification (EMM). Similarly, we observed evidence of both confounding and EMM by race and ethnicity on the estimate of odds of mothers reporting increased physical activity for their children at follow-up, whereby a stratum-specific crude OR varied (59% change in estimate, with imprecise and overlapping 95% CIs), and differed from the overall crude OR. We observed greater percent-changes in estimate between the stratum-specific crude odds in the full study population, as compared to the non-pregnant population.

Table 3: Odds of Maternally-Reported Changes in the Physical Activity of Children[1]

	Total (N=224)	Child Increased Activity (n=133)	p-Value[2]	Unadjusted (Crude) OR[1]		Fully Adjusted Model OR[1,3]		Minimally Adjusted Model OR[1,4]	
		n (%)		cOR	95% CI	aOR	95% CI	aOR	95% CI
Mother's Age (Mean, SD)	(40.1, 9.6)		.14	--	--	--		--	
Mother's Age			.49						
18-34	69	45 (33.8)		1.47	(0.73 - 3.00)	--		--	
35-44	96	55 (41.4)		1.06	(0.55 - 2.03)	--		--	
45-69	59	33 (24.8)		ref	--	--		--	
Race and Ethnicity			.27						
African American	55	28 (21.1)		0.83	(0.33 - 2.15)	0.63	(0.22 - 1.84)	0.61	(0.22 - 1.72)
African Immigrant/Refugee	23	14 (10.5)		0.56	(0.28 - 1.12)	0.55	(0.25 - 1.18)	0.50	(0.24 - 1.06)
Hispanic/Latinx	83	54 (40.6)		ref	--	ref	--	ref	--
Native Hawaiian/Pacific Islander	34	23 (17.3)		1.11	(0.49 - 2.61)	1.17	(0.46 - 3.06)	1.24	(0.50 - 3.21)
American Indian	29	14 (10.5)		0.51	(0.22 - 1.18)	0.46	(0.18 - 1.15)	0.45	(0.18 - 1.11)
Intensity of Study Arm			>.99						
High Intensity	126	75 (56.4)		1.02	(0.59 - 1.73)	1.11	(0.61 - 1.99)	1.06	(0.60 - 1.88)
Low Intensity	98	58 (43.6)		ref	--	ref	--	ref	--
Number of Children in Household			.79						
1-2 Children	110	64 (48.1)		ref	--	ref	--	ref	--
3 or More Children	114	69 (51.9)		1.10	(0.65 - 1.88)	1.29	(0.70 - 2.39)	1.19	(0.65 - 2.18)
Family in Poverty at 4 Months			.20						
Income Less than 100% Federal Poverty	115	67 (51.1)		ref	--	ref	--	ref	--
Income 100-129% Federal Poverty Level	35	18 (13.7)		0.76	(0.36 - 1.62)	0.81	(0.36 - 1.82)	0.68	(0.31 - 1.49)
Income 130% or Higher Federal Poverty Level	67	46 (35.1)		1.55	(0.83 - 2.95)	1.72	(0.84 - 3.61)	1.52	(0.76 - 3.08)
Self-Rated Health at Baseline			.78						
Fair/Poor	118	69 (52.7)		0.91	(0.53 - 1.56)	0.94	(0.50 - 1.77)	0.97	(0.53 - 1.80)
Good, Very good, Excellent	102	62 (47.3)		ref	--	ref	--	ref	--
Mother Experienced a Weight Loss of ≥5% at 4 Months			.69						
Yes	31	17 (12.8)		0.80	(0.38 - 1.73)	0.74	(0.32 - 1.70)	--	--
No	193	116 (87.2)		ref	--	ref	--	--	--

Table 3: Odds of Maternally-Reported Changes in the Physical Activity of Children[1]

	Total (N=224)	Child Increased Activity (n=133)	p-Value[2]	Unadjusted (Crude) OR[1]		Fully Adjusted Model OR[1,3]		Minimally Adjusted Model OR[1,4]	
		n (%)		cOR	95% CI	aOR	95% CI	aOR	95% CI
BMI at Baseline			.44						
Underweight/Normal weight	41	28 (21.1)		1.57	(0.77 - 3.36)	0.96	(0.45 - 2.02)	**2.48**	**(1.08 - 6.09)**
Overweight	54	31 (23.3)		1.00	(0.53 - 1.90)	2.23	(0.94 - 5.69)	1.13	(0.55 - 2.33)
Obese	129	74 (55.6)		ref	--	ref	--	ref	--
Did the Woman's Daily Physical Activity Change Between Baseline and 4 Months?[5]			.17						
Increased >1 Level	104	67 (50.4)		1.48	(0.87 - 2.53)	1.55	(0.84 - 2.89)	1.60	(0.89 - 2.94)
Did not Increase	120	66 (49.6)		ref	--	ref	--	ref	--
Woman Agrees that she Doesn't Have a Safe Place to Exercise.			.16						
Agree/Strongly Agree	21	9 (6.8)		ref	--	ref	--	--	--
Disagree/Neutral/NA/ Don't Know/Not Sure	203	124 (93.2)		2.06	(0.85 - 5.15)	1.54	(0.55 - 4.47)	--	--
Woman Agrees that There is too Much Pollution or Noise to Exercise			.44						
Agree/Strongly Agree	33	22 (16.5)		ref	--	ref	--	ref	--
Disagree/Neutral/NA/ Don't Know/Not Sure	191	111 (83.5)		0.71	(0.32 - 1.50)	0.52	(0.20 - 1.25)	0.54	(0.23 - 1.24)
Woman Agrees that Exercise is not as Important as Other Things			>.99						
Agree/Strongly Agree	36	21 (15.8)		ref	--	ref	--	ref	--
Disagree/Neutral/NA/ Don't Know/Not Sure	188	112 (84.2)		1.06	(0.51 - 2.16)	1.58	(0.69 - 3.63)	1.38	(0.64 - 2.95)
How Often do you Make Healthy Choices About Diet or Physical Activity Because you Want to be Healthy for your Children? (Follow-Up)			.75						
Usually or Always	172	101 (75.9)		0.90	(0.47 - 1.67)	0.58	(0.27 - 1.20)	--	--
Sometimes/ Rarely/ Never	52	32 (24.1)		ref	--	ref	--	--	--

Table 3: Odds of Maternally-Reported Changes in the Physical Activity of Children[1]

	Total (N=224)	Child Increased Activity (n=133)	p-Value[2]	Unadjusted (Crude) OR[1]		Fully Adjusted Model OR[1,3]		Minimally Adjusted Model OR[1,4]	
		n (%)		cOR	95% CI	aOR	95% CI	aOR	95% CI
How Often do your Children Encourage you to do Healthy Things Such as Eating Right, Exercising or Quitting Smoking? (Follow-Up)			.32						
Every Day	91	59 (45.7)		1.52	(0.67 - 3.44)	1.76	(0.72 - 4.37)	--	--
A few Times a Week	97	53 (41.1)		1.00	(0.44 - 2.22)	1.05	(0.43 - 2.56)	--	--
Yearly - Never	31	17 (13.2)		ref	--	ref	--	--	--

[1]Odds of reporting an increase in child's/children's physical activity at follow-up compared to no increase in physical activity.

[2]Fisher's exact 2-side p-value reported. Means of mother's age compared, as reported increased physical activity among children versus children who did not increase physical activity, using pooled (equal variance) 2-sided t-test as indicated by Folded F Test (p=0.85).

[3]Fully adjusted includes all covariates included on the DAG on biasing pathways (Kid PA = Mom PA + Race and Ethnicity + Study Arm + Household Size + Poverty + Health + Weight Loss + BMI + Safe Place + Pollution + Attitude + Healthy Choices + Kids Encourage).

[4]Minimally sufficient set for estimating the direct and/or total effect as indicated by the DAG included: Baseline BMI, Baseline health status, Exercise importance attitude, No. of children, Pollution and/or Noise, Poverty, Race/Ethnicity, Study arm.

[5]Mother's physical activity changes calculated as a reported change in weekly physical activity category more than one category level from baseline to follow-up. (4-month). Change categories included: none, less than 20 minutes, 20-29 minutes, 30-59 minutes, 1 hour to less than 1.5 hours, 1.5 to less than 2 hours, 2 to less than 2.5 hours, 2.5 to less than 3 hours, 3 or more hours. Overall, mother's mean physical activity increased an average of 1.26 category levels from a mean of 5.53 (1 hour but less than 1.5 hours) to 6.79 (1.5 hours but less than 2 hours) (Paired T-Test, p<.0001).

Discussion and Health Implications

In this study, we found that four months after the wellness-coaching intervention, 59.4% of participants reported an increase in their children's exercise behaviors and 71.9% reported an increase in their children's FVI, with no notable difference between women randomized into the high-intensity versus the low-intensity study arms. These behavior changes reported in children indicate that wellness-coaching programs for women may impact their children's diet and exercise behaviors in the short-term, though the long-term implication is not clear.

Research has explored parents as "agents of change" within families and has shown that women's participation in lifestyle-change programs can have long-term positive impacts on their children's health behaviors. Examples include an increase in children's consumption of fruits and vegetables (longitudinal follow-up over two years)[19] and the improvement of their children's insulin resistance (longitudinal follow-up over three months).[20] These studies have focused on improving lifestyle behaviors (e.g., family nutrition/eating behaviors) and parenting skills related to these behaviors. These interventions prioritized the enhancement of parental self-efficacy through increasing nutritional knowledge and parenting skills related to eating and physical-activity practices in the home environment.[21,22,23] These parent-focused studies have demonstrated improvements to the health of offspring, including: 1) decreases in offspring BMI z scores;[24-28] 2) parental healthy BMI change as a predictor of healthy BMI change in offspring;[29] 3) improvements in family weight-related parenting practices that are associated with improvements in offspring's dietary intake;[19, 25,30] and 4) improvements in diet and activity behaviors in mothers, associated with improvements in diet and activity of offspring.[31]

The present data analysis found several factors that were associated with lower levels of behavior change in children. For example, we found that women who reported not having a safe place to exercise in their communities were less likely to report an increase in their children's exercise behaviors. Some participants, such as those from the African Immigrant/Refugee community felt uncomfortable exercising in public spaces. Other studies have found that children who live in unsafe neighborhoods, as reported by their parents, engage in physical activity approximately one day less per week than children whose parents report living in a safe neighborhood.[32] This finding emphasizes the importance of creating safe environments for physical activity as an important factor in increasing children's physical activity. We also found that women who felt that fruits/vegetables took too much time to prepare were less likely to report increases in their children's FVI. Higher rates of at-home food preparation are associated with a higher diet quality.[33] Educating women about ways to reduce preparation time, and providing meal-planning resources may lead to a higher likelihood of women cooking healthy foods like fruits and vegetables in the home.[34] We do not have data on women's shopping practices or grocery budgets. Future research should assess these factors in order to more fully understand barriers/facilitators to healthy household eating behaviors.

Key strengths of the UWAG study were the CBPR framework and the employment of women from each community as wellness coaches, which helped recruit and retain diverse study participants.[35] Involving community leaders as members of the research team may also have increased the number of participants who were recruited and retained through building community trust in the study. Another strength of this study was that it included participants from five different racial/ethnic groups residing in the same urban area, increasing the diversity and generalizability of the study. The two major ethnicities that were not included in this study were Caucasian and Asian individuals; these could be added in a future replication of this study.

A significant limitation of this study is the fact that assessment relied on self-report by the study's participants. For example, the health-behavior changes in children were reported by women, as directly measuring changes in children's behaviors was not a primary aim of the study. There were no objective data collected about physical activity in the women or children; all physical activity data were self-reported by participants. As a result of assessment based on self-report, the study's findings may reflect some response bias, such as recall bias or social-desirability bias, if women desired to portray their family health behaviors as healthier than they were in reality. Further, assessing dietary intake at baseline and again at four months—just one time over the course of a month—is a study

limitation. For example, seasonal changes in the availability of fruits and vegetables have been shown to impact servings consumed.[36, 37] Another limitation of this study is the short duration of assessment; future research should assess sustainability of behavior change over longer time periods. Future research focused on children's health behaviors should incorporate interview data with children, conducted by trained CWCs under the supervision of registered dietitian nutritionists, as well as objective measures of physical activity in both children and women. Additionally, future research should assess the role of other members of the household (e.g., significant other, other children) in the facilitation of household health-behavior changes.

This study provides some evidence that interventions targeting women may have an impact on children's diet and exercise behaviors in the short term. Studies targeting overweight/obese parents who have overweight/obese children aged five and under are particularly needed. Hesketh and Campbell noted that interventions aimed toward children under the age of five are rare, and interventions with infants and their mothers even rarer.[38] This lack of interventions is alarming, as data show how important maternal influence is on children's health, with an effect across the lifespan.

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Obesity in Pregnancy and its Effects: Utah 1993-2020

Elise Bellows, Sarah Canning, Paige Price, & Heather Ricart
/ University of Utah

Background

Obesity is a growing health problem that can adversely affect many aspects of health, including pregnancy.It is a common, serious, and costly disease that is more prevalent in disadvantaged and marginalized groups.[1] Along with the many associated public health implications of obesity, some are specifically important in pregnancy and pediatric health, posing a challenge on obstetrics practice.

The standard measure of obesity is body mass index (BMI). A BMI greater than 30.0 kg/m^2 is considered obese, with BMI < 18.5 kg/m^2 considered underweight, 18.5 $kg/m^2 \leq$ BMI $\leq$ 24.9 kg/m^2 as normal weight, and 25 $kg/m^2 \leq$ BMI $\leq$ 29.9 kg/m^2 as overweight.[2] While BMI can be reductive, it is the best tool for broad-based health policy perspectives.[3]

The seven domains of health influence obesity in pregnancy and its outcomes.[4] When a woman is struggling in one domain, it can affect her ability to achieve a healthy state in others. Social health has effects on physical activity and diet that can come with cultural roots. Emotional health can be severely affected by obesity with weight gain and postpartum depression. Intellectual health may influence knowledge of the negative effects that are associated with pregnancy and obesity. Low socioeconomic status (SES) mothers have a higher risk of becoming obese due to inability to afford healthy foods. Struggling with obesity makes it much more difficult to return to a healthy state in each of the seven domains of health. These domains influence obesity, which leads to predisposing factors and early mortality for mothers and their babies.[4]

Researchers have found a correlation between obesity and miscarriage, stillbirth, diabetes, high blood pressure, cardiac dysfunction, renal dysfunction, hepatic dysfunction, sleep apnea, and risk of Cesarean section.[5] Fetal risks in the setting of maternal obesity include birth defects, fetal macrosomia (larger than average size), impaired growth, asthma, and obesity.[6] The purpose of this data snapshot is to characterize and describe the prevalence of obesity during pregnancy and its associated consequences in Utah and the United States.

Status of the Literature

Data was gathered from the Utah Maternal and Infant Health Program from 1993 to 2020. This program is an ongoing statewide monitoring system. After delivery of a live birth, the parent/parents are given a worksheet to fill out that will be used to create the child's birth certificate; this worksheet also asks for information about the mother's prepregnancy weight, height, and other social history and is added to the Utah Birth Certificate database.[7] The BMI for each individual was calculated based on the data submitted to the Utah Office of Vital Records and Statistics. This data is then made available on the Public Health Indicator Based Information System (IBIS). Prevalence and 95% confidence intervals are reported. The national data used for comparison with the Utah data was obtained from the CDC website.

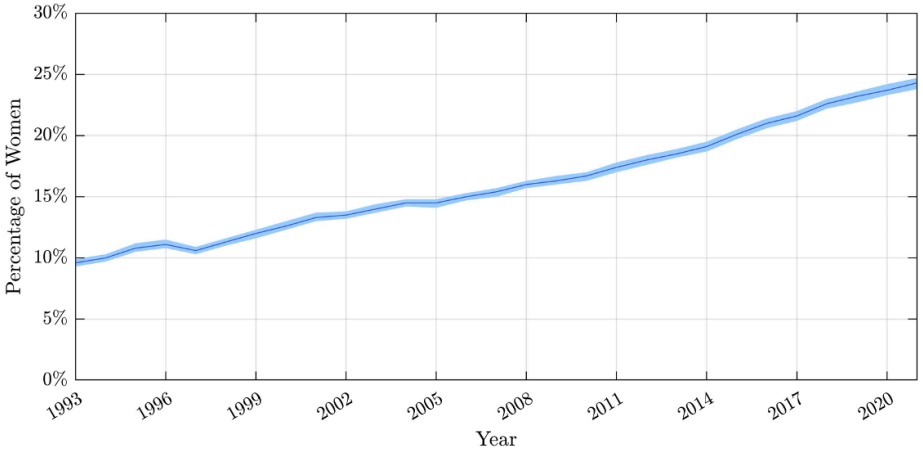
Results

Women who delivered a live birth during the years

1993 to 2020 and had a BMI that was classified as "obese" were used to calculate the following percentages. From Figure 1, it is evident that the prevalence of prepregnancy obesity has been increasing in Utah, reaching a high of 23.7% in 2020. However, this was still lower than the 2020 statistic for the entire United States of 30.0%.[8]

When comparing Figure 1 and Table 1, it is clear that prepregnant Utah women have a lower prevalence of obesity compared to women across the entire United States. However, both Utah and the United States show trends of consistent increase in prevalence of obesity.

Figure 1. Utah Women with an Obese BMI Prior to Pregnancy (1993-2021)[a]



a. Adapted from the Utah Department of Health and Human Services.[8]

Table 1. Pre-pregnancy Obesity in the United States by Maternal Race and Ethnicity from 2016-2019[a]

Year	Race and Ethnicity			
	Non-Hispanic white	Non-Hispanic Black	Hispanic	All Races and Ethnicities
2016	24.1%	36.4%	28.9%	26.1%
2017	24.9%	37.0%	30.1%	27.1%
2018	25.8%	38.0%	31.3%	28.1%
2019	26.6%	39.1%	32.4%	29.0%

a. Adapted from the Centers for Disease Control and Prevention.[9]

Table 2. Percent of Utah Women with Obese BMI by Race, 2019[a]

Race	Women Who Became Pregnant	All Adult Utahns
American Indian/Native Alaskan	37.4%	37.5%
Asian	9.9%	9.2%
Black	28.1%	31.6%
Pacific Islander	56.2%	51.0%
White	22.9%	29.3%
All Races	23.4%	29.5%

a. Adapted from the Utah Department of Health and Human Services.[8]

Table 2 compares the proportion of Utah women with a pre-pregnancy BMI of 30 or higher to the proportion of adult Utahns with a BMI in this range, stratified by racial group. Overall, only 23.4% of women who became pregnant were classified as obese, compared to 29.5% of Utahns as a whole. However, the proportion of Pacific Islanders with an obese pre-pregnancy BMI was higher than the overall proportion of Pacific Islander Utahns with an obese BMI (56.2% vs. 51.0%).

Discussion

Through the data gathered, it was found that of women who delivered live births, the proportion with a pre-pregnancy BMI of 30 kg/m2 or higher (those considered obese) has been steadily increasing. Since 1993, when the Utah Department of Health database first included this information, the percentage of obese pregnant women has increased from 9.6% to 23.7% in 2020. This number is lower than the United States average of 30% obese pregnant women in 2020, but still does not meet Healthy People 2030 objectives. By 2030, the Healthy People initiative aims to have 53.4% of U.S. women start pregnancy at a healthy weight; as of 2020, only 47.1% of Utah women met this standard.[8] In addition, obesity rates in pregnant women are higher among those with lower education levels, lower income, and no health insurance, as well as those of Pacific Islander, Black, American Indian/Alaskan Native races, or Hispanic ethnicity.[8]

The increasing rates of obesity are concerning because of the many effects this can have on the health of the mother and the baby. A woman who is not at a healthy weight before becoming pregnant is more likely to have longer hospital stays and need more medical attention during pregnancy.[8] Obese pregnant women are also at increased risk for many antepartum complications, including gestational diabetes, preeclampsia/eclampsia, stillbirth, and miscarriage.[10] They are more likely to have longer labors, more fetal distress, and require a Cesarean section or operative vaginal delivery.[8] This could possibly lead to more long-term health consequences as the newborn grows older and may affect subsequent pregnancies for the same woman. These complications can become very costly for the mother, especially considering that being below poverty level is a risk factor for obesity, and thus these women may be less able to afford treatment for these complications.

Much of what can be done in the public health sphere involves encouraging healthy weight and lifestyles before a woman even becomes pregnant. By doing so, public health can help prevent many of the complications that an obese woman may experience during pregnancy. Women should also receive regular well-woman care/visits from their primary caregivers. They can receive counseling, if needed, on weight, and on the risks that can come with an unhealthy weight once pregnant. Pregnant women should also receive proper education and counseling on healthy antepartum weight gain and postpartum weight loss.[8] Additionally, the Utah Department of Health hosts a program called Healthy Environments and Active Living that provides education on physical activity and healthy eating habits, available to all Utah citizens.

While the data on obesity in pregnancy is helpful in beginning to address the problem, there are some limitations to this data. Data was obtained based on self-reporting by the mother shortly after the birth, and may be inaccurate due to recall error or misreporting. Because of this, both the Utah and nationwide estimates of prepregnancy obesity may be underestimated. Since data was only obtained for live births, it is unknown how obesity affects the number of stillborn and miscarried fetuses. It is also difficult to separate obesity from confounding risk factors such as poverty, race, low education, and lack of medical care. More in-depth studies would be needed to determine how much obesity plays a role in pregnancy complications, as opposed to some of the other mentioned risk factors. Finally, BMI has been used for many years as a standard for measuring health, but it is limited in what it can say about the health of an individual. It does not take into account diet, exercise, or other lifestyle choices. It would be valuable to consider additional health measures, not just BMI, when determining the health of a pregnant woman.

Despite these limitations, the data in this snapshot is beneficial and can be applied to other locations. The data was obtained from Utah's birth certificate database. Birth certificates are documents produced nearly worldwide, and therefore this type of data collection can be repeated with many populations. Birth certificates only include live births, but they can be a good starting point to encourage more research in this area. The data may not be enough to draft policy, but it can

help direct public health officials and policymakers towards the public health issues that need more attention. More education should also be targeted at pregnant and prepregnant women, especially those of American Indian/Alaska Native and Pacific Islander descent, as they have the highest rates of obesity. Additionally, more research should be conducted on obesity in all pregnancies (not just those ending in live births) and should examine obesity more closely in those areas of the population that are already at risk, such as those of lower socioeconomic status. Through additional research, a more complete picture can be attained of the risks of obesity in pregnancy and what can be done to best help those women most at risk.

Acknowledgements

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Intellectual Health During Pregnancy

Alexiss Harward, Adriana Nuncio Zúñiga, & Lauren Greenwood
/ University of Utah

Problem Statement

A pregnant person's brain experiences incredible changes during and after pregnancy. Although there are numerous physical changes to the body during pregnancy, the intellectual changes impact brain structure and are not visibly noticeable. These structural changes related to the domain of intellectual health. Intellectual health includes a pregnant person's processing and memory abilities and the capacity to engage in creative, independent, and critical thoughts.[1] Further, these adjustments – often referred to as "pregnancy brain" – could include impacts to memory, concentration, and executive functioning.[2] Studies suggest that "pregnancy brain" is the brain's way of shutting off unnecessary functions, and instead prioritize functions necessary for the pregnant person to transition into parenthood, such as the ability to anticipate the offspring's needs.[3] This phenomenon, referred to as pruning, may even account for more efficient brain circuits.[4] In this commentary, we will outline the current research on the effects of pregnancy on pregnant people's intellectual health and brain functioning, while noting the limited literature available on this topic. We then propose potential next steps, which include expanding resources to support expecting parents and calling for additional research on the topic of supporting intellectual health during and after pregnancy.

Status of the Literature

While limited, the available literature that focuses on intellectual health during and after pregnancy further explores the negative and positive effects that take place associated with changes in brain structure and function. One study determined that "test results demonstrate deficits in learning and memory tasks, as well as in attention and language abilities during pregnancy".[2] These deficits occurred most often during the second and third trimesters by the effects of "hydrocortisone on acquisition and consolidation of information" and an increase in sex hormones.[2] Another study indicated that during pregnancy, it was common for the hypothalamus to shrink, a key indicator of overall brain health and short- and long-term memory capabilities.[5]

On the other hand, a decrease in brain matter also resulted in benefits for the pregnant person. Even though the brain of a pregnant person did shrink and some areas had a decrease in grey matter during the end of pregnancy, the brain refocused on others areas as it began to infer and predict what the infant's needs would be.[6] The common misconception is that the loss of grey matter during pregnancy has only negative affects, when in reality the brain is adjusting for more concise circuits and connections.[4]

It is also important to note that while there is limited literature on the changes to intellectual health during and after pregnancy, interventions specific to this population are lacking. Therefore, we propose several solutions in our call to action.

Call to Action

Intellectual health changes due to pregnancy are frequently understudied. Therefore, we recommend an increase in basic research about intellectual changes due to pregnancy. This research should address

physiologic and cognitive changes, their short- and long-term risks and benefits, and subsequent impacts on quality of life.

Another important step in creating positive change is an increased emphasis on development of high-quality, evidence-based health education materials about cognitive changes due to pregnancy. This material should consider health literacy challenges of target populations, emphasizing communication quality and addressing access barriers through involvement of trusted community partners. Thus, implementation research is needed to identify best practices and assess population-level impact, especially as studies suggest these changes may be lifelong.[7]

Since existing research is limited, an emphasis should be placed on further exploring ways to support intellectual health as pregnancy-related changes occur. We have briefly outlined changes occurring within the brain due to pregnancy and their potential impact immediately and into the future. As a result, we advocate for additional basic and applied research regarding intellectual health within the context of pregnancy.

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