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Leveraging Population Health Datasets to Advance Maternal Health Research

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Abstract

Background Maternal mortality is a public health crisis in the U.S., with no improvement in decades and worsening disparities during COVID-19. Social determinants of health (SDoH) shape risk for morbidity and mortality but maternal structural and SDoH are under-researched using population health data. To expand knowledge of those at risk for or who have experienced maternal morbidity and inform clinical, policy, and legislative action, creative use of and leveraging existing population health datasets is logical and needed.

Methods We review a sample of population health datasets and highlight recommended changes to the datasets or data collection to better inform existing gaps in maternal health research.

Results Across each of the datasets we found insufficient representation of pregnant and postpartum individuals and provide recommendations to enhance these datasets to inform maternal health research.

Conclusions Pregnant and postpartum individuals should be oversampled in population health data to facilitate rapid policy and program evaluation. Postpartum individuals should no longer be hidden within population health datasets. Individuals with pregnancies resulting in outcomes other than livebirth (e.g., abortion, stillbirth, miscarriage) should be included, or asked about these experiences.

Significance

We review population health datasets and provide recommendations that would enable maternal health researchers to unlock the full potential of these datasets by exploring the influence of structural factors and SDoH on maternal health among under-researched groups.

Keywords Maternal health · Pregnancy · Postpartum · Social determinants of health · Structural determinants of health

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Introduction

Maternal mortality is a public health crisis in the United States (US). There has been no improvement in the maternal mortality rate in decades despite substantial improvements in almost all other countries (Kassebaum et al., 2016; Petersen et al., 2019). In the US, maternal outcomes are plagued by longstanding disparities (Petersen et al., 2019; Hoyert, 2020). Non-Hispanic Black and Indigenous individuals are two to four times more likely to die due to pregnancy related complications compared to non-Hispanic white individuals (Petersen et al., 2019). Low-income individuals and those in rural areas are at higher risk of pregnancy and childbirth related morbidity and mortality (Merkt et al., 2021; Kozhimannil et al., 2019). Importantly, two thirds of maternal deaths in the US are preventable (Petersen et al., 2019). To minimize preventable maternal morbidity and mortality national attention is focused on improving maternal health equity through research, advocacy, policy, and legislation (Aina et al., 2019; Eckert, 2020).

Substantial research gaps remain in how to address preventable maternal morbidity and mortality. Social determinants of health (SDoH) shape risk for maternal morbidity and mortality but current evidence in the US suggests maternal SDoH are under-researched (Nelson et al., 2018; Wang et al., 2020). Structural SDoH represent the ‘root causes’ of inequity which occur outside of an individual’s sphere of control, which consequently create intermediary SDoH that reflect poor health outcomes. Understanding the complex relationship and mechanisms that link SDoH and maternal health requires a theory-based, equity focused lens is needed to diversify our understanding of how structural and social determinants influence maternal health to address disparities (Maternal Mortality Review Committees [MMRCs], 2018). Many existing, population based datasets provide an opportunity to understand experiences of pregnant and postpartum individuals through self-report of structural and SDoH alongside health behaviors, preferences, and outcomes. It is logical to leverage the strengths of population health datasets to evaluate the intersectional lived realities and contexts pregnant and postpartum individuals experience (Carbado et al., 2013). Unfortunately, examining important research gaps in maternal health at the population level has been hindered by a lack of observational datasets that identify pregnant individuals, especially among under-researched populations, in numbers sufficient to study these questions. Population health survey data can highlight the impact of SDoH on maternal health and lived experiences of individuals in ways that other large datasets, such as claims, are unable to. Without information at the population level about the role of SDoH in addressing maternal morbidity and mortality, policies or interventions are unlikely to be

optimally beneficial at-scale. Leveraging existing population health datasets to expand knowledge of those at risk for or who have experienced morbidity provides another avenue to gain more information about unique groups at risk for morbidity and mortality and their pregnancy and postpartum experiences to inform clinical, policy, and legislative action.

Our objective is to highlight opportunities to enhance SDoH focused research addressing preventable maternal morbidity and mortality and associated inequities through purposeful inclusion of pregnant and postpartum individuals. We review a sample of ongoing, publicly available datasets that lend themselves to research on less explored maternal SDoH at the population level. In the following text, we review each dataset, its purpose, strengths, limitations, and highlight recommended changes to the datasets or data collection to better inform existing gaps in maternal health research.

Datasets

National Health Interview Survey (NHIS)

Background

NHIS is a yearly, cross-sectional sample of the US civilian population conducted by the Centers for Disease Control and Prevention (CDC) (National Center for Health Statistics [NCHS], 2021a,b). NHIS topics range from physical/mental health and associated SDoH. Several standard NHIS topics are implicated with adverse maternal health outcomes but haven’t been studied at the population level nor in as much detail as NHIS survey provides. Capitalizing on NHIS’ uniquely powerful survey items; especially those that contextualize insurance status, mental health symptomatology/treatment, and nativity, is imperative to improve our understanding of, care for, and health outcomes among pregnant and postpartum individuals. While many measures focus on individual traits, researchers can leverage the availability of how these traits interact with structural factors (e.g., insurance status and policies, nativity and immigration policies) to unlock powerful information regarding how structural barriers shape health.

Inclusion of Pregnant and Postpartum Individuals

In 2020, NHIS included 31,568 [weighted N = 68,352,946] participants (Table 1). Less than 1% of the sample were pregnant (n = 176) [weighted n = 1,878,558; %95CI = 0.75, 0.48–0.65] and just under 1% postpartum (n = 306) [weighted N = 3,271,054; %95CI = 1.29, 1.13–1.49)].

Table 1 Inclusion of individuals across the perinatal period in population health datasets

	National health interview survey (NHIS)	National survey on drug use and health (NSDUH)	National health and nutrition examination survey (NHANES)	Behavioral risk factor surveillance survey (BRFSS)	National Survey on family growth (NSFG)	Pregnancy risk assessment monitoring system (PRAMS)
Most recent year available	2020	2020	2017–March 2020	2020	2017–2019	2019
Total sample* [weighted]	31,568 [68,352,946]	32,619 [275,149,463]	15,560 [322,324,172]	401,958 [260,408,470]	11,347 [144,893,811]	45,22 [2,332,161]6
n (% , 95%CI) pregnant individuals out of total sample unweighted	176 (0.56, 0.48–0.65)	421 (1.29, 1.17–1.42)	87 (0.56, 0.45–0.69)**	2,153 (0.54, 0.51–0.56)	189 (1.67, 1.45–1.92)	0
n(% , 95%CI) pregnant individuals out of total sample weighted	1,878,558 (0.75, 0.63–0.89)	2,029,045 (0.74, 0.62–0.86)	2,350,470 (0.73, 0.56–0.95)	2,168,333 (0.83, 0.76–0.91)	2,004,176 (1.38, 1.26–1.65)	0
n(%) postpartum individuals sampled	306 (0.97, 0.87–1.08)	0	237 (1.52, 1.34–1.73)	0	310 (2.73, 2.45–3.05)***	45,226(100%)
n(%) postpartum individuals weighted	3,271,054 (1.29, 1.13–1.49)	0	6,320,050 (1.96, 1.72–2.23)	0	2,999,265 (2.07, 1.79–2.39)	2,332,161 (100%)

*Total sample indicates all individuals (males & females) included in the dataset

For NHANES number of pregnant individuals includes females aged 20–44 d/t disclosure risks.

**NHANES pregnancy variable is derived from urine testing and survey (ridexpreg variable), uses exam weighting, postpartum question used interview weighting

***Year of last live birth question use

National Survey on Drug Use and Health (NSDUH)

Background

NSDUH collects yearly, national data from noninstitutionalized adults. Its purpose is to monitor trends in substance use and mental health to support prevention and treatment programs (National Survey on Drug Use and Health [NSDUH], 2020). NSDUH includes populations and geographical areas that may benefit from federal resource allocation for prevention and treatment of substance use disorders (NSDUH, 2020). Topics include SDoH such as employment status, sexual attraction and identity, self-perception of English language fluency, and interactions with the carceral system—all important, understudied determinants in maternal health. NSDUH includes past year and past 30 day illicit and licit substance use questions, DSM substance use disorder symptom questions, trimester of pregnancy, and explores perceived need, availability, and access to substance use and mental health treatment. Exploring structural factors, such as access to treatment, are necessary to move beyond individual risk to address system level barriers to program participation. These services are critical for improving treatment for maternal substance use disorders, as pregnant individuals have been disproportionately affected by the opioid epidemic (Magerison et al., 2022; Patrick et al., 2020; Creanga et al., 2014; Goldman-Mellor & Margison, 2019; Mangla et al., 2019), but difficult to study on a population level

due to small numbers. A holistic understanding of barriers and facilitators in treatment access for behavioral health disorders is needed to address stark disparities in behavioral health related deaths in the perinatal period (Magerison et al., 2022).

Inclusion of Pregnant and Postpartum Individuals

In the 2020 NSDUH cohort (N = 32,619 [N = 275,149,463 weighted]), 421 [weighted n = 2,029,045 pregnant individuals were interviewed, representing 0.74% (95% CI = 0.62, 0.86) of the total sample. No questions assess postpartum status.

The National Health and Nutrition Examination Survey (NHANES)

Background

NHANES is a cross-sectional survey used to assess health, chronic disease, and disease prevention. NHANES includes survey and physical examination data through yearly collection across the US (National Health and Nutrition Examination Survey [NHANES], 2018). These data are used to develop public health policy, construct public health programs, and examine impact of chronic disease guidelines on population health (NHANES, 2018). NHANES represents an excellent source to examine maternal SDoH due to its comprehensive set of questions regarding acculturation,

food security, nativity, and support during pregnancy and the postpartum year, especially among those who have chronic conditions.

Inclusion of Pregnant and Postpartum Individuals

The 2017–March 2020 NHANES sample includes 15,560 [weighted $N = 322,324,172$] individuals. There were few pregnant ($n = 87$ [weighted $n = 2,350,470$; 95% CI = 0.78; 0.56–0.95]) or postpartum individuals ($n = 237$ [weighted $n = 6,329,050$; %95 CI = 1.96; 1.72–2.23]).

The Behavioral Risk Factor Surveillance System (BRFSS)

Background

BRFSS represents the world's largest yearly data collection system, sampling over 400,000 respondents annually and gathering information about health-related risk behaviors, chronic disease, and health services use from US individuals. BRFSS includes data from 50 states and each state can add unique questions to the survey. Nearly two thirds of states have used BRFSS to influence health related legislative action (BRFSS, 2018). BRFSS employs disaggregated race/ethnicity information (e.g., Vietnamese, Pacific Islander, Native Hawaiian) for categories often presented in aggregate form in other datasets (e.g., Asian) in addition to multiracial race/ethnicity categories. Further, BRFSS allows respondents to identify sex assigned at birth, sexual orientation and identity, identifies transgender individuals, and incorporates the adverse childhood experiences survey.

Inclusion of Pregnant and Postpartum Individuals

In 2020 BRFSS surveyed 401,958 (weighted $N = 260,408,470$) participants (Behavioral Risk Factor Surveillance System [BRFSS], 2018). Pregnant individuals represented 0.83% of the total sample, or, 2,153 [weighted $n = 2,168,333$; %95 CI = 0.83; 0.76–0.91] individuals. Postpartum individuals cannot be identified.

National Survey of Family Growth (NSFG)

Background

The NSFG is conducted bi-annually with the goal of supporting the US Department of Health and Human Services in coordinating research on family planning, health, and fertility (National Survey of Family Growth [NSFG], 2019). NSFG stands apart from other national survey datasets due to inclusion of multiple perinatal specific questions, including key familial relationships. In congruence with these questions,

NSFG incorporates questions about attending pre/postnatal clinician visits, and if/why visits were not attended. Additional SDoH focused questions include workforce participation, identification of subgroups within the Hispanic ethnicity (e.g., Puerto Rican, Mexican Cuban), primary language spoken in the home, and youth foster care experiences. Further, NSFG includes 2 of 3 recommended questions to identify sexual orientation- useful in identifying pregnant and postpartum health needs, preferences, and outcomes among sexual minority populations (Limburg et al., 2020).

Inclusion of Pregnant and Postpartum Individuals

In the 2017–2019 cohort, of the 11,347 [weighted $N = 144,893,811$] individuals interviewed, 189 [weighted $N = 2,004,176$; %95 CI = 1.38(1.26–1.65)] individuals were pregnant, and 310 [weighted = 2,999,265; %95 CI = 2.07(1.79–2.39)] postpartum.

The Pregnancy Risk Assessment Monitoring System (PRAMS)

Background

PRAMS is coordinated by CDC and state public health departments. Participants are sampled from birth certificate data, with oversampling of racial/ethnic minoritized individuals and individuals whose infants had low birth weight (Pregnancy Risk Assessment Monitoring Tool [PRAMS], 2021). PRAMS data collection began in 1987, include a minimum of 52 core questions and encompasses data surveilling 83% of US births. PRAMS includes questions regarding SDoH, maternal attitudes, perceptions, and knowledge related to pregnancy, prenatal care, health behaviors, and infant care (PRAMS, 2021). PRAMS surveys all postpartum individuals between two and six months postbirth- a frequently unidentified group. Yet, questions provide limited insight beyond the early postpartum period.

PRAMS is unique; it includes a cohort of all postpartum individuals between two and six months postpartum, a group excluded from most of the other datasets we describe. In PRAMS, follow up interviews should be conducted again later in the postpartum year and include questions that meaningfully elucidate adverse health outcomes and associated contributors in the postpartum year.

Discussion

National surveys that produce population health data can quickly shed light on SDoH influencing outcomes among under-researched populations to inform action-oriented

policy, but only through meaningful inclusion representative of the nation's diversity.

An overreliance and emphasis on intermediary SDoH, which are driven by structural determinants may erroneously suggest that personal responsibility drives maternal health disparities. When instead, structural SDoH are major, causal drivers of maternal health outcomes, but remain less explored. Creative use of existing health databases (e.g., merging with other data sources, quasi-experimental study designs, and policy analysis) can help explore structural determinants and more importantly, support birthing individuals, their health and the health of their children. Future use of these datasets should incorporate SDoH in the larger context of policies, legislation, and other structural factors as they influence maternal health outcomes. Use of these datasets to their full potential will be unlocked when researchers explore the influence of structural factors and SDoH on maternal health.

Across each of these datasets, we found insufficient representation of pregnant and postpartum individuals; lack of such data limits responsiveness to maternal health needs during our country's ongoing maternal health crisis. Better representation can evaluate and target perinatal access to effective interventions and treatments.

Recommendations

The following recommendations will enhance these datasets to inform maternal health research:

1. Pregnant and postpartum individuals should be oversampled in population health data to facilitate rapid policy and program evaluation aimed at improving maternal health. NHIS, NHANES, BRFSS, and NSFG included between 0.73 and 1.38% pregnant individuals.

2. Postpartum individuals should no longer be hidden within national datasets. Postpartum individuals should be identified, including time since birth. NHIS, NHANES, and NSFG asked about postpartum status and these datasets included 1.29–2.07% postpartum individuals.

3. Individuals with pregnancies resulting in outcomes other than livebirth (e.g., stillbirth, abortion, miscarriage) should also be included, or questions asked about these experiences.

These changes would allow the maternal health community to leverage the strengths of these unique datasets to help understand the role of structural and SDoH in driving adverse perinatal outcomes. Advancing maternal health equity is a national priority but efforts to adjust our ongoing, robust data collection are needed to reflect this.

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Declarations

Competing Interests The authors declare that they have no conflicts of interest.

Consent to Participate (Ethics) This is a commentary that uses all publicly available de-identified secondary data sources.

Consent to Publish (Ethics) This is a commentary that uses all publicly available de-identified secondary data sources.

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