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Individual and community-level risk factors for maternal morbidity and mortality among Native American women in the USA: protocol for systematic review

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ABSTRACT

Introduction Incidents of maternal morbidity and mortality (MMM) continue to rise in the USA. Significant racial and ethnic health inequities exist, with Native American (NA) women being three to four times more likely to die than white, non-Hispanic women, and three to five times more likely to experience an incident of severe maternal morbidity. Few studies have identified individual and community-level risk factors of MMM experienced by NA women. Therefore, this systematic review will identify said risk factors of MMM experienced by NA women in the USA.

Methods and analysis This systematic review will be conducted according to the Cochrane Handbook for Systematic Reviews, and the findings will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA). The search strategy will include searches from electronic databases: PUBMED, EMBASE, CINAHL and SCOPUS, from 1 January 2012 to 10 October 2022. The search strategy will include terms related to the search concepts: 'maternal', 'Native American' and 'MMM'. Bibliographies of selected articles, previously published reviews and high-yield journals will also be searched. All included papers will be evaluated for quality and bias using NIH Quality Assessment Tools for Observational Studies. A description of the study findings will be presented in a tabular format organised by outcome of interest along with study characteristics.

Ethics and dissemination There are no formal ethics approvals needed for this protocol. The findings of this systematic review will be shared with academic, governmental, community-based, institutes and NA (tribal) entities via a published peer-reviewed article, informational brief, poster and oral presentations.

PROSPERO registration number CRD42022363405.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This review will contribute to the evidence gap in maternal health for Native American communities.
⇒ This review will access four databases, hand search table of contents of high yield journals and the reference lists of identified articles and include grey literature.
⇒ Two independent reviewers will conduct screening and data extraction to reduce bias with a third reviewing as the arbitrator.
⇒ Heterogeneity in measures of association for severe maternal morbidity is expected due to the large diversity of multiple study designs, risk factors and outcomes incorporated in the review.
⇒ The review is descriptive and meant to guide future research for better understanding of the individual and community-level risk factors specific to Native American women.

INTRODUCTION

Maternal morbidity and mortality (MMM) continue to be alarming public health problems in the USA. The Centers for Disease Control and Prevention (CDC) defines maternal mortality as the death of a woman during pregnancy, at delivery or soon after delivery.[1] Maternal morbidities range from minor complications to near-miss events that could lead to death without timely identification and treatment.[2] Over the past four decades, the rate of pregnancy-related deaths has drastically increased since by 150%.[1] The USA has one of the highest maternal mortality rates of any high-income country, reporting 26.4 maternal deaths per 100 000 live births, a stark contrast to Finland's, with the lowest maternal mortality rate of 3.8 maternal deaths per 100 000 live births.[3] Significant racial and ethnic health inequities exist in maternal health.[4–6] Native American (NA) women are three to four times more likely to die than white women in the USA and three to five times more likely to experience an event of severe maternal morbidity than white non-Hispanic women.[4 5]

Severe maternal morbidity refers to unexpected labour and delivery outcomes with serious short-term or long-term health consequences (eg, blood transfusion, pre-eclampsia or hysterectomy).[6]

While the reason for this increase in MMM and their expanding inequities is not entirely understood, there are a variety of determinants or factors that affect maternal health outcomes before, during and after pregnancy. These factors interplay at varying levels, including among patients and families, providers or facilities, overall systems and within the community. According to the WHO's Maternal Morbidity Working Group (MMWG), maternal morbidity refers to 'any health condition attributed to and/or complicating pregnancy and childbirth that has a negative impact on the woman's well-being and/or functioning'[7]. This framework aims to understand maternal morbidity better, leading to a lesser population burden as better policies are implemented and tailored services are provided. The guidance includes six key principles (1) the importance of using a woman-centred approach, (2) maternal morbidity risks are cyclical, (3) the effects of maternal morbidity can last a long time, (4) maternal health is a social and economic phenomenon, (5) context and environment influence the lived experience of morbidity and (6) alignment with other WHO guidance.[7]

Adverse maternal health outcomes for NA women have been associated with historical trauma, racism, colonisation, genocide, forced migration, reproductive coercion and cultural erasure.[8–10] NA women also experience unique prolonged systematic barriers that create inequitable social conditions compared with other groups.[10–12] Some systemic barriers affecting maternal outcomes for NA women include limited access to providers and birthing facilities, toxic stress due to systemic racism, unconscious biases by providers, lack of trust in health systems, and a declining health workforce among other factors.[10 13] These and other barriers can lead to MMM. In addition, a history of forced sterilisation and forced infant and child separations has led to a strong distrust of healthcare systems and providers, including the Indian Health Service.[14–16]

Despite these concerns, a comprehensive body of literature that supports the presence of these and other risk factors specific to NA women is scarce. Few studies have identified risk factors for MMM experienced by NA women. A recent scoping review synthesised available literature concerning NA women and the leading causes of maternal mortality in the USA.[17] The scoping review identified risk factors contributing to maternal mortality, such as historical trauma, inequities in healthcare availability, access and utilisation, pre-existing health conditions and rurality.[17] A systematic review of social determinants of pregnancy-related mortality and morbidity identified that race was a significant factor for maternal morbidity and that NA women were 1.3 to 1.8 times higher in experiencing any form of severe maternal morbidity compared with white women.[18]

However, the review did not produce a list of risk factors specific to NA women, nor did it include a study that evaluated maternal deaths among NA women.[18] There is a need to explore further and assess the quality of research specific to risk factors for MMM experienced by NA women. Compiling this information can further highlight areas for maternal morbidity and mortality prevention in NA communities. Therefore, this systematic review aims to comprehensively assess the available literature to further expound on the relationships between risk factors and maternal morbidity and mortality in NA women.

OBJECTIVE

The objective of this systematic review is to identify individual and community-level risk factors for pregnancy-related morbidity and mortality experienced by NA women in the USA and, using the new WHO conceptual framework for maternal morbidity to improve understanding of maternal morbidity, identify potential areas for research and public health interventions to reduce disparities in NA communities further.

METHODS

This systematic review will be conducted according to the guidance of the Cochrane Handbook for Systematic Reviews and the findings will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA) .[19]

Protocol registration

This systematic review protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD42022363405. Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022363405). This protocol is written in accordance to the PRISMA-P.[19]

Study selection

Types of studies

Epidemiological observational studies such as cross-sections, case–control and cohort studies published since 2012 will be included. Systematic reviews, scoping reviews, conference abstracts, comments, reviews, letters, or case reports will not be included.

Types of participants

The review will include studies focusing on NA women in the perinatal or puerperium periods (ie, relating to the time immediately before and after birth). Studies focusing on a different population will be included if they offer a stratified analysis by race and contain a racial category for NAs.

Types of exposures/risk factors

The review aims to identify a comprehensive list of risk factors for MMM for NA women at the community and individual levels. Community-level risk factors refer to

Table 1 Severe maternal morbidity indicators

Diagnosis SMM indicators	Procedural SMM indicators
Acute myocardial infarction	Blood transfusion
Acute renal failure	Conversion of cardiac rhythm
Adult respiratory distress syndrome	Hysterectomy
Amniotic fluid embolism	Temporary tracheostomy
Aneurysm	Ventilation
Cardiac arrest	
Disseminated intravascular coagulation	
Eclampsia	
Heart failure	
Puerperal cerebrovascular disorders	
Pulmonary oedema	
Sepsis	
Severe anaesthesia complications	
Shock	
Sickle cell anaemia with crisis	
Thrombotic embolism	

conditions and settings that increase the likelihood of an adverse health outcome (eg, rurality, lack of resources, unemployment and safety).[20] Individual-level risk factors refer to those factors that are biological or personal that increase the likelihood of a specific health outcome (eg, insurance status, preexisting chronic disease, and substance use behaviour).[20] The scope of the review is structured so that all possible risk factors will be documented and sorted into the community and individual levels.

Types of outcomes

The primary outcomes of interest are morbidity and maternal mortality, including severe maternal morbidity (SMM). SMM are unexpected outcomes of labour and delivery that result in significant short-term or long-term consequences to a women's health and include diagnoses such as aneurysm, eclampsia, sepsis and shock.[6] SMM can also refer to invasive procedures during childbirth, such as hysterectomy, ventilation and transfusion of blood products. The CDC identified a list of 21 diagnoses and procedures to identify SMM found in table 1.

This list will be used to organise extracted measures of effect during the analysis phase of the review.[6] Given the scope of this review, the terms 'pregnancy complications', 'obstetric complications', 'labour complications' and 'near-miss' were added to the list of outcomes to increase the sensitivity of the review. Pregnancy, labour and obstetric complications all refer to conditions or pathological processes associated with pregnancy.[21] They can occur during or after pregnancy, ranging from minor discomforts to severe diseases requiring medical interventions. They include diseases in pregnant women and pregnancies in women with diseases. Near-miss refers to an event that presented a risk but did not result in death. Maternal mortality refers to the death of a woman while pregnant or within 1 year of the end of a pregnancy, regardless of the outcome, duration or site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.[22]

Eligibility criteria

The review will use the following inclusion criteria to determine eligible studies: (1) epidemiological observational study; (2) study is set in the USA; (3) population was NA women in the perinatal or puerperium period; (4) outcomes focused on measures of pregnancy-related mortality and morbidity (including near-miss events or complications during the pregnancy or the labour process) and (5) examined the relationship between a risk factor/exposure and stated outcomes. Studies focusing on a different population will be included if they offer a stratified analysis by race and contain a racial category for NA women. The review will exclude (1) studies that focus only on birth, neonatal or infant outcomes; (2) studies that do not examine the relationship between a risk factor/exposure and stated outcomes; (3) studies with settings outside of the USA; (4) studies that do not include findings for NA women and (5) studies that focus on the preconception or postpartum phases.

Search strategy

The search strategy will include searches from electronic databases: PUBMED, EMBASE, CINAHL and SCOPUS from 1 January 2012 to 10 October 2022. The search strategy will include terms related to three search concepts 'maternal', 'indigenous' and 'maternal morbidity and mortality'. With technical assistance from a specialised health sciences librarian, the team will use search tools and strategies specific to each database, including truncation of keywords where appropriate, use of thesaurus terms, and use of database-specific controlled vocabulary (eg, Medical Subject Headings, MeSH). The search strategy will combine terms and search strings with the appropriate Boolean operators (ie, AND/OR). The review team will hand-search the table of contents of high-yield journals and the reference lists of identified articles and scoping reviews on the topic for additional studies. Only studies published since 2012 will be included. The year 2012 was chosen because the CDC released a new standard for monitoring severe maternal morbidity on 12 November 2012.[23] This new standard is incorporated into the outcome definition for this review. The final PRISMA diagram will be presented. We have included the overall search strategy in box 1, and the detailed strategy for PubMed in box 2. No language restrictions will be applied.

The search strategy was pilot tested and finalised on 10 October 2022. The results from each database-specific search strategy will be downloaded from the respective databases and uploaded to the EndNote V.20 reference

Box 1 Search strategy

Search query

⇒ **#1** delivery OR birth OR labour OR mothers OR maternal OR peripartum OR obstetric OR pregnanc OR perinatal OR prenatal OR parturition

⇒ **#2** tribal OR tribe OR 'Indian Health Service' OR indigenous OR 'Native American' OR 'American Indian' OR first nations OR 'Alaska Native'

⇒ **#3** 'severe maternal morbidity' OR 'near miss' OR 'pregnancy complications' OR 'mortality' OR 'morbidity' OR 'labour complications' OR 'delivery complications' OR 'maternal mortality' OR 'maternal morbidity' OR 'adverse maternal outcomes'

⇒ **#4** Search (#1 AND #2 AND #3)

Box 2 Pubmed search strategy

⇒ **#1** birth[(tiab]) OR labour[(tiab]) OR delivery[(tiab]) OR mothers[(-tiab]) OR maternal[(tiab]) OR 'peripartum period'[(mesh]) OR peripartum[(tiab]) OR 'labour, obstetric'[(mesh]) OR 'obstetric' [(mesh]) OR 'obstetric' [(tiab]) OR 'pregnancy'[(mesh]) OR 'pregnan' [(tiab]) OR 'perinatal' [(tiab]) OR 'prenatal'[(tiab]) OR 'parturition'[(mesh]) OR 'parturition'[(tiab])

⇒ **#2** 'tribal' OR 'tribe' OR 'first nations' OR 'indigenous peoples'[(mesh]) OR indigenous OR 'health services, indigenous'[(mesh]) OR 'American Indians or Alaska Natives'[(mesh]) OR 'American Indian' OR 'Indians, North American'[(mesh]) OR 'Native American' OR 'Alaska Native'

⇒ **#3** 'severe maternal morbidity' OR 'near miss' OR 'adverse maternal outcomes' OR 'maternal mortality' OR 'Near Miss, Healthcare'[(Mesh]) OR 'Pregnancy/Adverse Effects'[(Mesh]) OR 'Pregnancy/Injuries'[(Mesh]) OR 'Pregnancy/Mortality'[(Mesh]) OR 'Pregnancy/complications'[(Mesh]) OR 'Obstetric Labour Complications'[(Mesh]) OR 'Delivery, Obstetric/adverse effects'[(Mesh]) OR 'Delivery, Obstetric/complications'[(Mesh]) OR 'Delivery, Obstetric/mortality'[(Mesh]) OR 'Maternal Mortality'[(Mesh]) OR 'mortality'[(mesh]) OR 'morbidity'[(mesh]) OR 'pregnancy complications' OR mortality OR morbidity OR 'labour complications' OR 'delivery complications'

⇒ **#4** Search (#1 AND #2 AND #3)

manager software.[24] Duplicates will be checked for and removed using EndNote V.20 (Clarivate, Philadelphia, Pennsylvania, USA) and Covidence (Melbourne, Victoria, AU), a reference software for article screen reviews and data extraction.[25] To decrease error, the principal investigator will manually check each possible duplicate before removal. The updated library will be saved in Covidence.

Before the first screen of titles and abstracts, the team will ensure consistency and rigour during the screening process by randomly selecting 10 articles to assess interrater reliability. A scorer sheet will be completed, and α kappa's coefficient will be calculated to measure agreement and identify any issues with review procedures. If the team achieves a low kappa coefficient (ie, less than 0.80), the review team will discuss the differences in scores. Inclusion and exclusion criteria will be clarified, and testing of interrater reliability and discussion will be repeated until agreement reaches an acceptable level (near 0.80). Once interrater reliability has been attained, two independent reviewers will begin to screen the titles and abstracts based on the eligibility criteria mentioned before to determine which studies should be included for full-text screening. If any disagreement occurs, the two reviewers will discuss and resolve any issues. If no consensus is reached, a third reviewer will arbitrate. After the title and abstract screening, two independent reviewers will screen full-text articles for inclusion into the review for data extraction and quality assessment processes. If any disagreement occurs, the two reviewers will discuss and resolve any issues. If no consensus is reached, a third reviewer will arbitrate. For each excluded article, the reasons for exclusion will be referenced at each screening stage.

Data extraction

Once there is a final list of full-text articles, two independent reviewers will extract data using a piloted data extraction form in Covidence. The form collects data on study details such as location, study design and eligibility criteria, methods, year of the article, year(s) of study, data source, objectives, sample size and population, independent (risk factors) and dependent (outcomes) variables, key findings, measures of effect/association with p values and confidence intervals, and limitations. The two reviewers will meet to resolve and discuss any disagreements. However, if disagreements persist, a third reviewer will arbitrate. For any missing information, the reviewers will contact the corresponding authors to request any updates on the missing items. Authors will be contacted a maximum of three times via email and/or phone. The principal investigator will randomly sample 5% of articles to confirm the data extraction accuracy. Any discrepancies with data extraction will be reviewed and discussed in a team setting. The review team will meet biweekly to discuss obstacles and identify solutions. Any changes to the approach will be documented.

Data management

Covidence will be used for the title and abstract screening, full-text screening, data extraction and quality assessment. All tools and forms developed in Covidence will be piloted and calibrated before use. After each step, a backup database will be saved. Reasons for excluding articles at each stage and reviewer notes will be documented in Covidence. Any amendments to the protocol or progress updates will be reported as an update in PROSPERO and communicated to the research team.

ANALYSIS

Data synthesis

A description of the findings for each included study in the review will be presented in a table of findings, considering the risk factors and outcomes of interest and study characteristics. A descriptive synthesis of the results will be most appropriate for this review since there will be a

large diversity of study designs, risk factors and outcomes. The heterogeneity of the studies included in this review impedes any quantitative synthesis of the identified risk factors' effect sizes. The review will provide a comprehensive list of the risk factors for maternal morbidity and mortality experienced by NA women in the USA. The findings will also be organised into (1) community and (2) individual levels. Articles that include similar risk factors will be grouped by the risk factor. Information that will be reported per risk factor includes (1) the number of studies that used a risk factor; (2) the number of studies that had a measure of effect for a risk factor and was reported to be statistically significant and (3) the number of studies that did not report a measure of effect for the risk factor but either: (a) included the risk factor in an adjusted model, (b) stratified their analysis by a risk factor or (c) excluded subsets of the population based on a risk factor. Ratings and descriptive information for each article will be provided in tabular format. Forest plots for each risk factor will be used to plot individual study effects without a combined effect estimate when deemed appropriate. The review team will engage in ongoing, iterative discussions to deepen and extend the initial analysis produced. The review team will also attempt to further organise the findings into four categories of the WHO's Conceptual Framework for Maternal Morbidity: (1) laws and policies, (2) health system and quality of care, (3) preexisting socioeconomic status and (4) health status.[7] Categories 1 and 2 represent community-level risk factors while 3 and 4 represent individual-level risk factors.

Risk of bias and quality assessment

The risk of bias will be assessed using the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies, and Case-Control Studies.[26] Established in 2013, the National Health, Lung, and Blood Institute developed a set of tailored quality assessment tools to assist reviewers in focusing on key concepts to a study's internal validity.[26] The tools are specific to certain study designs and tested for potential study methods or implementation flaws. These two tools provide a practical and direct approach to evaluating the final articles. Articles in the review will be rated by two independent reviewers as 'good', 'fair'"or 'poor' quality. A rating of 'good' means that there is the least risk of bias, and the results are considered valid. A 'fair' rating indicates susceptibility to some bias but is still deemed insufficient to invalidate its results. Articles with a 'fair' rating will vary in their strengths and weaknesses. A 'poor' rating indicates a significant risk of bias. If the ratings differ, the reviewers will discuss the article to reach a consensus. If consensus is not achieved, a third reviewer will arbitrate. All studies regardless of their rating will be included in the findings table. Results of the quality assessments for the included studies will be provided as a supplementary table along with the final rating.

ETHICS AND DISSEMINATION

There are no formal ethics approvals needed for this protocol. Stakeholder engagement is critical for the success of this project, especially in the widespread dissemination of findings to various audiences. The findings of this systematic review will be shared with academic, governmental, community-based, institutes and NA (tribal) entities via a published peer-reviewed article, informational brief, poster and oral presentations. The findings will also be disseminated via non-traditional forms of data dissemination designed to meet the needs of diverse audiences (eg, storytelling vignettes, informational videos, or radio public service announcements).

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Contributors MFC and PM: developed the protocol objectives and design. MFC wrote the protocol and is the submitting author under the supervision of PM and JMC. MFC and JMC developed the search strategy presented in the protocol. JMC and PM reviewed the written protocol and provided final approval of the version to be published. AZ, CR, AN, and AA provided substantial feedback in the final written manuscript.

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