Recommendations for Maternal Mortality Review Committees in the United States: A content analysis

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Abstract

Background: Every year up to 700 mothers die in the United States due to pregnancy complications; at least two-thirds of these deaths are preventable. Despite the presence of state-level Maternal Mortality Review Committees (MMRCs), mortality rates have remained stagnant or increased in many places. Implementing best practices to improve MMRCs may help identify and address the causes of maternal mortality that may be preventable.

Methods: We conducted a content analysis of evidence-based recommendations to improve MMRCs. Using a search of PubMed, we restricted our analysis to full-text papers published in English from 2010-2021 that included recommendations. Reviewer 1 (R1) analyzed the initial set of papers and removed any that did not meet the inclusion criteria. R1 coded the recommendations into categories. Reviewer 2 (R2) coded them separately. R1 and R2 then agreed to a common codebook and re-coded all papers for relevant themes.

Results: Out of 322 articles identified in PubMed, 16 articles met the inclusion criteria. The articles all acknowledged gaps in current MMRC practice and policies. Recommendations included ensuring representative and diverse committee representation, improving data quality and standardization, and performing in-depth review of cases of maternal death to look for social determinants of health. Several other themes arose regarding funding, support for, and review practices of MMRCs.

Conclusion: This is the first study to collect evidence-based recommendations to improve MMRC effectiveness. We offer next steps and best practices to policymakers and MMRCs at a time when reducing maternal mortality rates is a national priority.

Background

Maternal mortality is a pressing health issue in the United States as the rate of maternal deaths continues to increase even as the global maternal mortality rate is steadily declining. [1] Maternal mortality is defined as a death attributable to “a pregnancy complication, chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy”. [1] Approximately 700 mothers die in the United States every year due to pregnancy complications or complications during delivery. [2] According to the Centers for Disease Control and Prevention (CDC) 2018 Pregnancy Mortality Surveillance System (PMSS), US maternal mortality increased from 7.2 to 16.9 deaths per 100,000 live births between 1987 and 2016. [2] The aforementioned Pregnancy Mortality Surveillance System during 2011–2016, identified racial/ethnic disparities among pregnancy related deaths in the United States where the highest number of maternal deaths was accounted among black non-Hispanic women compared to other racial and ethnic groups.[2] This increase in maternal mortality rate represents a serious concern as it directly reflects the consequences of poor investment in maternal health in a country that spends more than any other country on health care, as a whole.[3] The death of a mother represents not only the loss of an individual woman’s life but also has a far-reaching negative impact on the health

of her family and children. Maternal deaths are just the tip of the iceberg of maternal morbidity; it is estimated that for every pregnancy- related death, 70 to 100 women suffer a serious pregnancy-related illness. [3]

The leading causes of all pregnancy related deaths in the United States are hemorrhage (14.4%), cardiovascular and coronary conditions (15.5%), infections (13.4%), cardiomyopathy (10.3%) and mental health conditions (11.3%). [2,3] While there is significant evidence around identifying and understanding the leading causes, identifying preventable causes of death, and intervening on those causes continues to remain a challenge.

Maternal Mortality Review Committees help identify causes of maternal deaths, contributing factors, and whether maternal deaths were preventable.[4] They are primarily operated at the state level while some local jurisdictions, such as New York City, also run their own committees. [4] MMRCs were formed to provide in-depth reviews of maternal death that are more consistent and organized. They require robust guidelines, resources, time-intensive review of maternal deaths and standardized measures by all MMRCs established across the United States to create constructive and fruitful outcome in reducing maternal mortality. [4,5] The current state-by-state and locality-by-locality approach introduces considerable variation in the processes surrounding and supporting MMRCs. [5]

The need to develop strategies to prevent maternal deaths as well as to examine the maternal death should be addressed therefore, to fulfil these needs MMRCs were formed in the year 1930 at the state and local levels. [5] Maternal Mortality Review Committees review wide number of pregnancies associated deaths, but it needs a defined scope to systematically abstract and review cases. [5] MMRCs help identify various potential errors that could be prevented by rigorous examination of the data, data matching and use of ICD-10 obstetric cause-of-death code. [5, 6] By identifying the patient factors, health care provider factors, or system factors as well as demographic causes of maternal death, MMRCs offer a chance to systematically address causes of maternal mortality. [6]

MMRCs focus on identifying cases, reviewing maternal deaths, and preparing summaries of the cases aimed at answering six essential questions as shown in the table below: [4,6]

Table 1
Six essential questions and actions of MMRC

Questions	Actions
1) Was the death pregnancy related?	MMRCs review cases that are identified in the state level where committee first identifies if the case being reviewed is related to pregnancy.
2) What was the underlying cause of death?	Use of Maternal Mortality Review Information Application (MMRIA) helps to identify the underlying cause of death.
3) Was the death preventable?	Committee determines if the pregnancy related death is preventable, and whether there are possibilities of changes that could be made to address patient/family, community, provider, facility and system factors.
4) What are the factors that contributed to the death?	Contributing factors are categorized into patient/family, provider, facility, system and community. They also address issues related to knowledge, access, communication, continuity of care and clinical skills under those categories.
5) What are recommendations and actions that address those contributing factors?	Committee addresses specific and feasible recommendations to strengthen and improve systems and focuses on responsible parties to prevent pregnancy related deaths in the future.
6) What are the anticipated impacts of those actions if implemented?	Recommended strategies are decided by the committee representatives for implementing recommendations into actions.

*Note: Table 1 Six essential question and actions of MMRCs. Adapted from Report from Nine Maternal Mortality Review Committees. Review to Action [4]

Previously published systematic literature reviews have explored the causes of pregnancy related deaths across the United States, but their scope has been limited to identifying the recommendations to reduce the causes at the state-level. There are gaps in identifying the variability in MMRC practice and the relationship to increasing or stagnant maternal mortality rates in the United States; only a few researchers have explored these actions, strategies and barriers that may be influencing MMRCs to be less effective in various states.[6]

Studies that focus on the systematic guidance in reducing maternal mortality by strengthening MMRCs are very rare at the national level, especially at a time where the maternal mortality rate is alarmingly high. As states consider improving their maternal mortality review process, and in light of recent federal legislation to strengthen MMRCs among states, having access to best practices and recommendations for improving MMRC function becomes essential for members of MMRCs, policymakers, and state and federal authorities. [7] Therefore, this paper aims to provide a summary of actionable recommendations to improve the effectiveness of MMRCs in the United States with the aim of reducing maternal deaths.

Methods

Search Strategy

We conducted a comprehensive literature search in PubMed to identify papers that offered guidance and recommendations for strengthening and improving MMRCs. Using the search term “maternal mortality review committee,” we included papers with the keywords in their title or abstract, were published in the United States, and available in English with full text. We focused on 2010–2021 because the Joint Commission issued an alert in 2010 about the rise in maternal mortality rates, and the number of MMRCs increased from nine prior to 2010 to 46 as of 2020. [8]

Analysis

Within the subset of papers collected using the search term “maternal mortality review committee,” one reviewer reviewed the title and abstract of each paper to include only those papers that offered recommendations and guidance for MMRCs, excluding papers that described the work of MMRCs, that described cases that were reviewed by MMRCs, or that focused on causes of maternal mortality without addressing MMRC function. Two reviewers were involved in categorizing the papers to ensure inclusion and exclusion criteria were met.

The remaining articles were read in their entirety to identify common themes and recommendations for MMRCs. Reviewer 1 and 2 independently reviewed and categorized the papers, then compared their respective categorizations, addressed any discrepancies, and developed a final categorization scheme for the recommendations in the papers.

Results

The initial search resulted in 322 articles, after Reviewer 1 screened Title & Abstract for the inclusion criteria and excluded any papers that did not address MMRCs, did not address maternal mortality, or were not based in the US, 28 papers remained. A full-text review of those 28 papers resulted in the exclusion of 12 articles that did not include recommendations for MMRCs. The 16 articles that met the inclusion criteria were then reviewed for recommendations.

Eight recommendations for improving, supporting, and organizing MMRCs were identified from the content analysis (Table 2). The most commonly endorsed themes were: 1) establishing multidisciplinary and representative MMRCs, 2) improving data quality and management standards, and 3) performing in-depth reviews of pregnancy-related deaths to identify preventable deaths. Additional themes raised included: creating clear legislative mandates for MMRCs to review and address maternal mortality, establishment of a national MMRC, establishing a funding structure and resource supports for MMRC work, incorporating a health equity framework into the analysis of pregnancy-related deaths, and ensuring rural representation on boards in states with rural populations.

Table 2
Key themes of MMRC recommendations

Key Recommendations	Number of articles
Multidisciplinary and representative MMRC	11
Improving Data Quality and Management	5
In-depth review of pregnancy related deaths	4
Legislative mandates for MMRCs	2
Establishment of a national MMRC	2
Funding and resource support	2
Incorporation of health equity framework	1
Rural representation	1

Multidisciplinary and Representative MMRC

The most mentioned theme, identified as a priority by 11 of the 16 articles in this analysis, was the composition of the MMRC. Table 3 lays out the specific professions indicated by the authors in their articles. These professions varied in terms of their training in medicine, their training in social and behavioral health, their focus on population health, their role in healthcare delivery systems, and their role in patient representation and advocacy. Nine of the 11 articles endorsed the importance of public health experts on the MMRC. There was also wide agreement on the importance of having doctors and nurses on the board, though the specific disciplines differed across papers. The importance of mental and behavioral health professionals was endorsed by five papers, though again the specific recommended disciplines varied across papers. The inclusion of health administrators, hospital associations, or insurance providers were also mentioned by five papers. Together these recommendations represent attention to the inclusion of professionals with an understanding of maternal mortality in terms of patient-level, clinic-level, community-level, and system-level factors that can be addressed and prevented.

Table 3

MMRC composition recommendations [10,11, 12…,20]

Profession	# Endorsing	Endorsing Paper
Public health	9	Zaharatos et al. 2018, Geller et al. 2015, Kilpatrick et al. 2012, Koch et al. 2017, Lindsay et al. 2017, Shellhaas et al. 2019, Kozhimannil et al. 2019, Anderson et al. 2020, Smid et al. 2020
Obstetrics and gynecology	8	Zaharatos et al. 2018; Berg, 2012; Geller et al. 2015, Koch et al. 2017, Lindsay et al. 2017, Shellhaas et al. 2019, Anderson et al. 2020, Smid et al. 2020
Maternal-fetal medicine	8	Zaharatos et al 2018, Geller et al. 2015, Kilpatrick et al. 2012, Kilpatrick et al. 2012, Koch et al. 2017, Lindsay et al. 2017, Shellhaas et al. 2019, Anderson et al. 2020
Family medicine	2	Kilpatrick et al. 2012, Koch et al. 2017
Emergency medicine	2	Shellhaas et al 2019, Anderson et al. 2020
Cardiologist	3	Lindsay et al. 2017, Shellhaas et al. 2019, Anderson et al. 2020
Neonatology	4	Geller et al. 2015, Kilpatrick et al. 2012, Koch et al. 2017, Smid et al. 2020
Forensic pathology	6	Zaharatos et al. 2018, Berg 2012; Geller et al. 2015, Koch et al. 2017, Anderson et al. 2020, Smid et al. 2020,
Anesthesiology	5	Berg 2012; Geller et al. 2015; Koch et al. 2017; Shellhaas et al. 2019, Anderson et al. 2020
Pediatric health care professionals	1	Smid et al. 2020
Nursing	7	Zaharatos et al. 2018, Geller et al. 2015, Koch et al. 2017, Lindsay et al. 2017, Shellhaas et al. 2019, Anderson et al. 2020, Bradford 2021
Midwifery	8	Zaharatos et al. 2018, Berg 2012; Geller et al. 2015; Kilpatrick et al. 2012, Lindsay et al. 2017, Shellhaas et al. 2019, Anserson et al. 2020, Bradford H, 2021
Mental health	4	Zaharatos et al. 2018, Berg 2012; Koch et al. 2017, Smid et al. 2020
Substance use disorder experts	1	Smid et al. 2020
Behavioral health	3	Zaharatos et al. 2018, Berg 2012; Koch et al. 2017
Social services	4	Berg 2012; Koch et al. 2017, Shellhaas et al. 2019, Kozhimannil et al. 2019

Profession	# Endorsing	Endorsing Paper
Social workers	5	Zaharatos et al 2018; Berg 2012; Geller et al. 2015, Koch et al. 2017, Kozhimannil et al. 2019
Patient advocates	2	Zaharatos et al. 2018, Koch et al. 2017
Nutritionists	1	Shellhaas et al. 2019
Maternal child health administrators	1	Lindsay et al. 2017
Hospital associations	3	Berg 2012, Koch et al. 2017, Shellhaas et al. 2019
Managed care organizations	1	Shellhaas et al. 2019
Public Insurance Agencies	1	Anderson et al. 2020

Legislative Mandate for MMRC Reviews

Two papers acknowledged the need for a legislative mandate to codify and support state-wide MMRCs. [13, 14] Lindsay et al., 2017 [13] reflected on their experience re-establishing an MMRC in Georgia. They identified a problem where some MMRC members were unable to gain access to relevant case information and therefore were thwarted in their effort to review cases of maternal mortality. Therefore, they recommend the establishment of legal protections for members in MMRCs from civil and criminal liabilities, establishing MMRC member legal authority to review cases, and protocols for data collection such as those included in the Maternal Mortality Bill: Georgia Senate Bill 273. [13] Shellhaas et al., 2019 [14] recommend legislative and statutory protection to guide and support MMRCs in data collection, reporting, and review processes. Furthermore, the authors called for increasing legislative support in establishing MMRCs and passage of federal legislation to support MMRCs. [14] They further emphasized the need to increase legislative support in establishing MMRCs and passage of federal legislation to support all MMRCs in providing direction for data collection, review processes, and reporting. [13,14]

Data Quality and Management

Several recommendations to address the concerns about data quality and management arose from the reviewed papers. Data for MMRCs can be drawn from a variety of sources, including vital records, medical records related to birth, fetal death certificates, autopsy and coroner reports, social service records, health insurance records, and law enforcement records. [12, 15] One of the issues raised was misidentification of pregnancy-related deaths that can be addressed by accurately recording data in the death certificate and refining the methodology being used. [15] Papers asserted different recommendations for how to accurately record and standardize data.

Three of the papers [14, 16, 17] specifically recommend use of the Maternal Mortality Review Information Application (MMRIA) that allows access to and sharing of data across participating MMRCs in the United States. The MMRIA is a standardized data collection tool and data repository run by the CDC that facilitates MMRC investigations into maternal deaths. [16]

An additional suggestion endorsed [17] is the use of a checklist protocol to ensure easy access to data by authorized parties of MMRCs. These checklist tools help in maintaining confidentiality, protection of data, and determining the specific cause of pregnancy-related death. [17, 18]

In-Depth Review of Pregnancy-Related Deaths

Four of the papers [14, 16, 18, 19] recommended in-depth review of preventable maternal deaths by the MMRC. The primary concern of the authors here is that some of the factors that lead to maternal deaths such as suicide, drug overdose, and violence, are not typically included in MMRC analyses but are relevant causes of maternal mortality. Therefore, in addition to focusing on obstetric and clinical causes of maternal deaths, the authors argue it is important to structure the review process and the use of preliminary data of MMRCs to identify the exact causes of maternal deaths as well as to determine preventability. In addition, Anderson et al [16] further emphasized the need to create a standardized process for disseminating review information and follow-up across all MMRCs. Shellhaas et al [14] and Main EK (2012) [18] each reiterated the importance of MMRCs answering the six review questions delineated in Table 1.

Establish a National MMRC

Two papers Zaharatos et al [20] and Clark et al [21] went further than recommending federal legislation to support MMRCs and instead recommended the creation of a national MMRC. They recommend the establishment of a national MMRC, reasoning that the incidence of maternal mortality in any single state is fairly low, and therefore the ability to identify trends and patterns is hampered by limited statistical evidence. However, they argue, at a national level, the incidence of maternal death is high enough to allow analyses that can identify common risk factors and predictive variables in which we can intervene to prevent maternal death.

By contrast, some articles mentioned that the state based MMRC could often get a more detailed and nuanced picture of the characteristics of the health system and population in the state, allowing for a more sensitive analysis of the causes and preventability of maternal deaths. While not explicitly recommending state only MMRCs, it is worthwhile to note that there is not universal agreement on the benefits of a national MMRC.

Funding and Resource Support for MMRCs

Two articles (Anderson et al [16] and Kozhimannil et al [22]) recommend increasing and codifying funding for MMRCs. These funds are intended to support the ongoing work of the MMRC including hiring support staff members. This can also support the time MMRC members spend conducting thorough reviews of maternal death, potentially improving the thoroughness of each review. Kozhimannil et al [22]

specifically discussed funding and resources as essential for supporting maternal mortality review and action across rural states in the United States.

Rural Representation on MMRCs

While many papers endorsed specific professions that ought to be included on the MMRC, Kozhimannil et al [22] identified geographic representation as an important factor to consider in states with heavy rural populations. Specifically, the authors recommend the establishment of MMRCs in states with rural areas to identify the gaps related to geographical coverage of quality services and the inclusion of rural representatives on MMRCs in states with substantial rural populations. [22] They recognize that despite the increasing establishment of MMRCs, lack of development and support for MMRCs in heavily rural states as well as lack of attention to rural communities in states with existing MMRCs have limited the ability of MMRCs to see and respond to the circumstances that contribute to maternal mortality in rural populations. [22] They note that pregnancy-related complications and death are highly prevalent in rural areas, and therefore rural inclusion and representation on MMRCs is important to consider.

Incorporation of a Health Equity Framework and SDoH

Kramer et al [23] recommend the incorporation of a health equity framework within MMRCs to provide a contextual framework for pregnancy-related deaths that are related to social determinants of health and are frequently not included within existing MMRC review protocols. The health equity framework helps to identify underlying community-based factors related to racial and geographical inequity that contribute to or cause maternal mortality.[23] They argue that addressing maternal mortality effectively must include attention to social determinants of health that are infrequently treated as causes of death.[23]

Discussion

This content analysis is the first to provide a synopsis of the recommendations for MMRCs in the peer-reviewed literature. The results are intended to help MMRC committees, policymakers, and state and federal leaders establish resources and practices that can facilitate the power of MMRCs to identify causes of and intervene in maternal mortality. Improving the function of MMRCs is crucial first step in reducing maternal mortality in the US, a Healthy People 2030 goal.[24]

Maternal mortality is an important indicator that helps to determine health system performance in the United States and high-income countries (Report from Maternal Mortality Review Committees, Review to Action, 2017).[25] National reports from the CDC's Review to Action group recognize that building capacity to review and intervene in maternal mortality is an essential public health intervention (Report from Maternal Mortality Review Committees, Review to Action, 2017).[25] MMRCs can be strengthened if all states reflect on, share, and improve their MMRC review processes. Sharing some of those best practices is the goal of this paper, and administrators and policy makers seeking to reduce maternal mortality would do well to consider improving the quality of reviews using all or some of the recommendations included in this paper. Additionally, resources like the *Committee Facilitation Guide*

from Review to Action offer guidance and a logic model to assist states without fully functional MMRCs in developing review capacity. [25] All MMRCs should continue to adopt the standardized database, Maternal Mortality Review Information Application, that facilitates comprehensive, timely, and accurate recording as well as abstracting data from clinical and non-clinical sources. [26]

This analysis offers recommendations from the peer-reviewed literature. However, the analysis is limited because the search strategy did not identify other potential sources of recommendations, such as white papers, reports, and other non-peer reviewed material. Additionally, our analysis does not identify MMRCs that may be making many of the recommended changes and taking the recommended actions. Nor do we have outcomes from those MMRCs that have made changes. Nevertheless, as the only review article we have seen, this paper facilitates the quick identification of best practices and recommendations for MMRCs currently examining their practices and considering changes to protocols and resources.

Approximately 69% of the final articles in this content analysis recommend expansion of the expert panel and advisory committee to include multiple disciplines. Specifically, including disciplines which offer a non-medical approach to understanding maternal mortality creates a pathway for MMRCs to understand both medical and non-medical contributors of maternal deaths and plan interventions accordingly.

Conclusion

This content analysis has focused on actionable recommendations and strategies that help to strengthen the MMRCs across the United States. The major strength of this study is it identifies potential opportunities to improve maternal mortality review, a key element in the effort to decrease preventable maternal deaths. Future research should be done to identify the circumstances and resources that improve the quality of reviews, dissemination practices, and efforts by MMRCs and states to increase awareness of their role and advocacy around reducing maternal mortality.

Abbreviations

CDC: Centers for Disease Control and Prevention

PMSS: Pregnancy Mortality Surveillance System

MMRC: Maternal Mortality Review Committee

MMR: Maternal Mortality Rate

MMRIA: Maternal Mortality Information Application

Declarations

Declaration

Not Applicable

Ethics Approval and consent to participate

Not applicable

Consent for publication

This content analysis did not involve research on human subjects and no personal information is used, therefore the work is not eligible for IRB review.

Availability of data and materials

The data described in this article can be freely and openly accessed at CDC website: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-relatedmortality.htm

Competing interests

The authors do not have conflicts of interest to declare, and no products or services are discussed in the manuscript.

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This content analysis did not involve research on human subjects and no personal information is used, therefore the work is not eligible for IRB review. We also did not receive funding to support the work. The authors do not have conflicts of interest to declare, and no products or services are discussed in the manuscript.

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Author's Contribution

A.S., J.H. and S.L. designed and directed this content analysis. A.S provided conceptual idea about the issues related to maternal mortality review committees across the United States, JH refined the idea and

gave a structural framework for the content analysis. A.S. took the lead in writing manuscript. A.S. conceived the present content analysis by using database i.e., PubMed Central, and identified the present topic related to maternal mortality review committee. A.S. designed the evidence- based framework retrieved from the articles in the PubMed Central under the guidance of J.H. and S.L. to perform quality synthesis of final articles. JH proposed quality synthesis method by using two- independent reviewers. A.S. identified 322 articles, synthesized 104 articles that were filtered from the database as per our inclusion criteria, performed Title and Abstract screening then extracted 28 articles for Full-Text screening. A.S. and J.H. conducted 2-independent review for quality synthesis for final 16 articles where reviewer 1 (AS) reviewed all 28 articles and reviewer 2 (JH) reviewed 25% of articles. J.H. contributed to reviewing and generating refined themes with brief explanation to each theme. J.H. and S.L. thoroughly reviewed entire manuscript, provided critical feedback, helped shape the content analysis.

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Figures

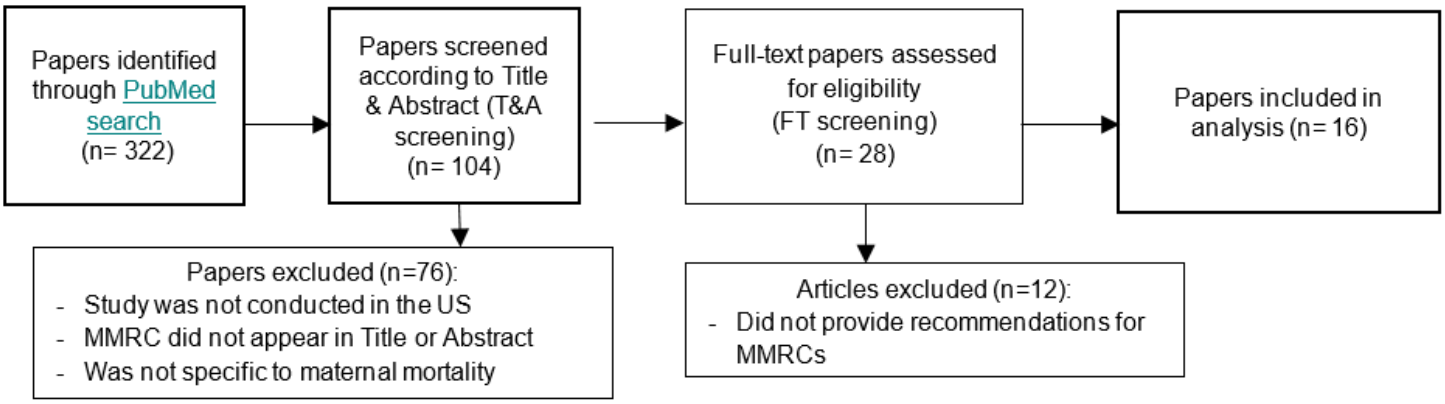

Figure 1

Search strategy process for the content analysis. Adapted from “the value of a second reviewer for study selection in systematic reviews” by Stoll CRT, Izadi S, Fowler S, Green P, Suls J, Colditz GA Res Synth Methods. 2019 Dec;10(4):539-545 [9]