HHS Public Access

Author manuscript

Arch Womens Ment Health. Author manuscript; available in PMC 2024 April 08.

Published in final edited form as:

Arch Womens Ment Health. 2024 February ; 27(1): 109–125. doi:10.1007/s00737-023-01375-4.

Consensus pregnancy-related criteria for suicide and unintentional overdoses using a Delphi process

Marcela C. Smid[1,2], **Porcia Vaughn**[3], **Christine Cooper Nowicki**[4,5], **David A. Goodman**[4], **Julie Zaharatos**[4], **Kristine A. Campbell**[3]

[1]Division of Maternal Fetal Medicine, Department of Obstetrics and Gynecology, University of Utah Health, Salt Lake City, UT, USA

[2]Program for Addiction Research, Clinical Care, Knowledge and Advocacy (PARCKA), Division of Epidemiology, Department of Internal Medicine, University of Utah School of Medicine, Salt Lake City, UT, USA

[3]Department of Pediatrics, University of Utah School of Medicine, Salt Lake City, UT, USA

[4]Centers for Disease Control and Prevention, Atlanta, GA, USA

[5]CDC Foundation, Atlanta, GA, USA

Abstract

Suicide and unintentional overdose are leading manners of preventable death during and within a year of pregnancy. Recently, the Utah Maternal Mortality Review Committee (MMRC) developed 10 criteria to guide pregnancy-related classification of these deaths. Our objective was to (1) evaluate if consensus could be reached across experts in maternal mortality review when applying criteria to the determination of pregnancy-relatedness in mock MMRC case evaluation and (2) assess how additional case information shifted participants' determination of pregnancy-relatedness in these mock cases. We used a modified Delphi process to evaluate criteria for pregnancy-related suicides and unintentional overdose. The study team developed base case scenarios to reflect the 10 proposed criteria. Base scenarios varied in timing of death (prenatal or delivery, early postpartum (<6 months), late postpartum (6–12 months)) and level of additional information available (e.g., informant interviews, social media posts). Consensus in favor of a criterion was met when ≥75% of participants identified a case as pregnancy-related in at least 1 scenario. Fifty-eight participants, representing 48 MMRCs, reviewed scenarios.

✉Marcela C. Smid, Marcela.Smid@hsc.utah.edu.

Declarations

Competing interests Marcela C. Smid's institution receives research funding from Gilead Sciences Inc. She has served as a consultant for Gilead Science Inc, Organon and Rhia Ventures.

Disclaimer The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Each author has confirmed compliance with the journal's requirements for authorship.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00737-023-01375-4.

Of 10 proposed criteria, 8 reached consensus. Overall, participants classified 19.4% of base case scenarios as pregnancy-related, which increased to 56.8% with additional information. Pregnancy-related classification changed across timing of death and with availability of additional information (prenatal or delivery 27.7% versus 84.6%; early postpartum 30.0% versus 58.3%; late postpartum 0.0% versus 25.0%, respectively). We identified consensus supporting the application of 8 standardized criteria in MMRC determinations of pregnancy-relatedness among suicide and unintentional overdose deaths.

Keywords

Maternal mortality; Suicide; Drug overdose; Delphi method

Introduction

In the USA, suicide and unintentional overdose are leading manners of preventable death during and within a year of pregnancy (Bruzelius and Martins 2022; Petersen et al. 2019; Trost et al. 2021). State and local Maternal Mortality Review Committees (MMRCs) determine if a death during and within 1 year of pregnancy is pregnancy-related, defined as death from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy (Reviewtoaction.org. 2018). Pregnancy-related death categorization helps to increase legislative awareness and direct federal and state funding to prevent these deaths (United States Government Accountability Office Congressional Requesters 2020). Recently, the Utah MMRC developed pregnancy-relatedness criteria that specify pregnancy complications, chain of events, and aggravations of conditions to guide evaluation of suicides and unintentional overdose deaths (Smid et al. 2020a). Prior to implementation of these criteria (2013–2014), 17% of these deaths in Utah were classified as pregnancy-related compared to 94% post-implementation (2015–2016). Between these 2 time periods, Utah's overall pregnancy-related mortality ratio increased from 11.8 to 25.7 per 100,000 births. Centers for Disease Control and Prevention (CDC) Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM) program has highlighted these criteria in their technical assistance to funding recipients (Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM) 2021). While some states have adopted these criteria, national expert consensus has not been established. Achieving consensus around criteria for pregnancy-relatedness of suicide and unintentional overdose deaths could facilitate precision and comparability of MMRC data across time and place.

The objective of this study was to (1) evaluate if consensus could be reached across experts in maternal mortality review when applying criteria to the determination of pregnancy-relatedness in mock MMRC case evaluation and (2) assess how additional case information shifted participants' determination of pregnancy-relatedness in these mock cases.

Methods

Definitions

Pregnancy-associated deaths occur during pregnancy or within 1 year of the end of pregnancy, regardless of the cause (Reviewtoaction.org 2018). Pregnancy-related deaths are those pregnancy-associated deaths determined by the MMRC to be the result of a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy (Reviewtoaction.org 2018). A simple way of considering pregnancy-relatedness is to ask: “if this person had not been pregnant, would they have died?” (Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM) 2021).

MMRCs are multidisciplinary groups with expertise in obstetric care, public health, nursing, forensic pathology, social work, mental health and behavioral health, and community members. Within a local or state jurisdiction, MMRCs comprehensively review available information, including medical records, autopsy reports, and other relevant sources, to understand the circumstances of a death and determine if the death is pregnancy-related (Fig. 1). Additional critical steps in the MMRC review are identifying contributing factors to individual deaths and developing recommendations for preventing similar deaths in the future.

Design

We used a modified Delphi process to identify a consensus approach for review and classification of pregnancy-associated suicide and unintentional drug overdose deaths by MMRCs. The Delphi process is a consensus-building technique that uses an iterative process of assessing individual participant opinion, statistical summaries of responses, and group feedback of anonymized summary statistics to achieve convergence of participants’ opinions around a question for which empirical evidence is unavailable (Fink et al. 1984; Jones and Hunter 1995; Murphy et al. 1998; Niederberger and Spranger 2020). Strengths of the Delphi process include anonymity of participants and feedback of group responses, supporting convergence of opinion through normative processes (Barrios et al. 2021). We supplemented statistical summaries with qualitative comments gathered from participants at each point of assessment. We selected the Delphi technique based on the need for expert consensus in the absence of empirical proof that can establish the pregnancy-relatedness of any specific maternal death and the need for anonymity for expert panelists based on potential for real or perceived hierarchy within the multidisciplinary MMRC context.

Experts

We recruited multidisciplinary participants representing all 50 US MMRCs active at the time of this study, alongside national and international participants with experience in maternal mortality, substance use disorders (SUD), and mental health. We first approached the chairperson(s) and coordinator of each MMRC for descriptive data on the composition of, function of, and data sources accessed by their committee. Each coordinator was asked to nominate up to 3 committee members as potential Delphi participants. Nominees were recruited via email. Consenting participants were enrolled and received a gift card of $50 for

each Delphi round completed. We assessed self-report demographic information including age, race and ethnicity, current or past MMRC service, and professional role to determine diversity of participant composition.

Consensus tool development

We developed the consensus tool with case scenarios reflecting the clinical and social circumstances proposed in each of the 10 Utah MMRC criterion for pregnancy-related categorization (Table 1) (Smid et al. 2020a) to test if each criterion met expert consensus for inclusion into proposed national criterion. We developed and modified mock case scenarios from real MMRC cases aggregated by CDC. For each scenario, a base case was developed for 3 time points: prenatal or delivery, early postpartum (within the 6-month postpartum), and late postpartum (6–12-month postpartum). Early and late postpartum time points reflected previously published reports describing increased risk of suicide and unintentional overdose after 6-month postpartum (Goldman-Mellor and Margerison 2019; Schiff et al. 2018; Smid et al. 2020b). The time point of 7-week postpartum was chosen to occur after the “6-week” postpartum appointment. For consistency between cases, early postpartum scenarios occurred at 7-week postpartum, and late postpartum cases occurred at 8-month postpartum. For each base case, we developed additional information (e.g., medical record details, informant interviews, or suicide notes tailored to each case scenario) to test the effect of information on the consensus process. The consensus tool was piloted by 2 non-participating MMRC members and revised for clarity. For each case, participants classified the relatedness of each pregnancy-associated suicide or unintentional overdose on a 9-point Likert scale (1=not pregnancy-related; 9=pregnancy-related) at the different pregnancy and postpartum time points. Participants evaluated each case using base information and then again using supplemented information.

Assessment, summary, feedback, and iteration

The consensus tool was distributed to participants via Research Electronic Data Capture (REDCap), a secure webbased database platform, over 3 assessment rounds during June–October 2021 (Fig. 2) (Harris et al. 2009). After each round, summary statistics and anonymized comments were distributed.

In Round 1, experts assessed pregnancy-relatedness of each case scenario using a 9-point Likert scale and free-text commentary. In Round 2, experts re-assessed pregnancy-relatedness of each scenario after reviewing a visual and narrative summary of Round 1 results that included box plots of summary statistics (range of scores, median, interquartile ranges) and free-text comments. In Round 3, experts again re-assessed pregnancy-relatedness of each scenario in context of summary statistics and comments and mapped each scenario to the Utah MMRC criteria.

Consensus definition development

Round 3 results were used to define consensus for pregnancy-related suicide and unintentional overdose deaths. We set a conservative *a priori* definition of consensus for the Delphi process, requiring 75% of participants to classify a case as pregnancy-related (7–9 on a scale of 1–9) to be included in a consensus definition for pregnancy-related suicide

and unintentional overdose deaths (75% consensus threshold) (Barrios et al. 2021; Campbell et al. 2015; Campbell et al. 2021; Murphy et al. 1998). We compared consensus based on case timing (prenatal, early postpartum, and late postpartum) and case information (base and supplemented).

To provide context for the proposed consensus definition, free-text comments from each round were categorized thematically by 2 investigators (PV and KC) and reviewed by the primary investigator (MS). Consensus findings were sent back to participants for review and feedback after the final round.

The study was reviewed and approved by the Institutional Review Board of the University of Utah.

Results

Multidisciplinary participants

Fifty active MMRC members representing 48 MMRCs (96% response rate) and 9 additional individuals with experience in maternal mortality, SUD, and maternal mental health consented to participation. One individual declined to participate after consent, leaving 58 participants for the final modified Delphi process (Table 2). Participants had a variety of experience in obstetric care (general obstetrics, maternal fetal-medicine, midwifery, and birth attendants), public health and policy, maternal mental health and substance use, and pathology (medical examiner, pathologist, coroner). Most participants had current (n=51, 88%) or past (n=2, 3%) MMRC experience. Of the 50 participants representing MMRC jurisdictions, 25 (50%) reported their MMRC currently used the published Utah criteria (Smid et al. 2020a). All 58 (100%) participants completed the first Delphi round, and 57 (98.3%) and 53 (91.4%) completed the second and third rounds, respectively. Fifty-three (91.4%) participants completed all 3 assessment rounds.

MMRC data

Of the 48 MMRCs represented, MMRC composition varied by number of committee members and number of cases reviewed annually (Table 3). Most MMRCs reviewed at least 1 suicide (77%) and 1 unintentional overdose death (85%) annually and had at least 1 member with maternal mental health and SUD expertise (Table 3). Most frequent data sources available to MMRCs included death records, autopsy reports, toxicology reports, and labor and delivery records (Fig. 3). Additional information such as mental health and substance use treatment records, informant interviews, child welfare records, Plan of Safe Care, and legal records were rarely, if ever, available for MMRC review (Fig. 3).

Consensus

Eight of 10 proposed criteria met the 75th% consensus threshold in at least 1 base or supplemental case related to that criterion (Fig. 4). Consensus varied based on timing of death and availability of supplemental information in all scenarios (Fig. 4). In base case scenarios, participant classification of deaths as pregnancy-related varied across all time points, 27.7% (prenatal/delivery), 30.0% (early postpartum), and 0.0% (late postpartum).

When additional information was available, participants classified 84.6% (prenatal/delivery), 58.3% (early postpartum), and 25.0% (late postpartum) of the case scenarios as pregnancy-related. Overall, participants classified fewer than 1 in 5 base cases (19.4%) as pregnancy-related (7–9 on Likert scale), while most cases with additional information (56.8%) were classified by participants as pregnancy-related.

Category 1 (pregnancy complications)

Deaths attributed to increased pain directly attributable to pregnancy or postpartum events, leading to self-harm or drug use that are implicated in suicide or unintentional drug-related death (Criteria 1a), reached the 75th% consensus threshold as pregnancy-related only in supplemented cases during the prenatal period (Fig. 4). Deaths attributed to a traumatic event in pregnancy or postpartum with a temporal relationship between the event leading to self-harm or increased drug use (Criteria 1b) achieved consensus in supplemented cases across all time points. Deaths attributed to a pregnancy-related complication likely exacerbated by drug use (Criteria 1c) only applies to the prenatal or delivery period, and consensus was achieved in both base and supplemented cases.

Category 2 (chain of events initiated by pregnancy)

Round 1 revealed 2 concerns embedded in 1 of the original criteria: Criteria 2a, cessation or attempted taper of medications for pregnancy-related concerns (fear of neonatal/fetal exposure risk or fear of Child Protective Service involvement) leading to maternal destabilization, or drug use and subsequent death. Participant comments suggested different weighting for elements of “fear of neonatal/fetal exposure risk” and “fear of Child Protective Service involvement.” This prompted partition of this case scenario to reflect 2 potentially distinct criteria in subsequent rounds. For Criteria 2a.1 “cessation or attempted taper of medications for pregnancy-related concerns of neonatal/fetal exposure risk leading to maternal destabilization or drug use,” consensus was achieved across all cases except the base case in the late postpartum period. However, for Criteria 2.a.2, “cessation or attempted taper of medications for pregnancy-related concerns due to fear of Child Protective Service involvement leading to maternal destabilization or drug use,” consensus was achieved only for the supplemented case for the prenatal period.

Deaths attributable to inability to access inpatient or out-patient SUD or mental health treatment due to pregnancy (Criteria 2b) achieved consensus for the supplemented case in the prenatal period and for base and supplemental cases in the early postpartum period. Deaths attributable to perinatal psychiatric conditions resulting in maternal destabilization or drug use (Criteria 2c) achieved consensus for base and supplemented cases in both the prenatal and early postpartum periods. Deaths attributable to recovery or stabilization of substance use in pregnancy with subsequent return to use and overdose (Criteria 2d) did not reach consensus as pregnancy-related in any scenario.

Category 3 (aggravation of underlying conditions)

Deaths attributable to worsening of underlying depression, anxiety, or other psychiatric condition in pregnancy or postpartum period with documentation that mental illness led to drug use or self-harm (Criteria 3a) and exacerbation, undertreatment, or delayed treatment

of pre-existing condition in pregnancy or postpartum leading to use of prescribed or illicit drugs (Criteria 3b) reached consensus only in supplemented cases in the prenatal and early postpartum periods. Deaths attributable to medical conditions secondary to drug use in setting of pregnancy or postpartum that may be attributable to pregnancy-related physiology and increased risk of complications (Criteria 3c) did not reach consensus under any scenario.

Participant feedback

Participants' comments identified common themes around information gaps and timing of deliveries. Participants frequently noted that basic medical information was typically insufficient to categorize a suicide or unintentional overdose death as pregnancy-related, and that supplemental medical and non-medical information (e.g., informant interviews, obituaries, social media posts, etc.) was important in making this determination. Participants indicated that information sources necessary to make the determination were often missing, particularly SUD and mental health care records that provide insight into how pregnancy and the postpartum period affected trajectories of these conditions. Consistently, participants commented that making pregnancy-relatedness determinations was most difficult in the late postpartum period, both in this process and in real MMRC deliberations. Two common themes were (1) lack of data sources available to establish a connection between the pregnancy and death and (2) that by the late postpartum period, substance use, and mental health became disentangled from the pregnancy. After Round 3, 11 participants provided individual feedback about suggested changes to the criteria that did not meet consensus of ≥75% (Criteria 2d and 3c). Common themes included that these criteria reflected "real-life" scenarios, but that determination of pregnancy-relatedness was difficult when numerous social (e.g., role of pregnancy in destabilization, partner's role) and medical factors (e.g., difficult determining the degree to which substance use exacerbated underlying perinatal physiology) were present. Another theme from participant comments was the reluctance to apply pregnancy-related criteria that required interventions outside of the medical system (e.g., expansion of harm reduction services to marginalized communities, expansion of maternal mental health awareness in non-medical settings).

Discussion

This study defines 8 consensus criteria that can be used by MMRCs when determining the pregnancy-relatedness of suicide and unintentional overdose deaths. Overall, participant determination of pregnancy-relatedness varied by timing of death and availability of additional information. These consensus criteria can support standardized approaches to MMRC evaluation of suicide and unintentional overdose deaths and strengthen maternal mortality surveillance approaches and development of prevention strategies. Our study demonstrates the need for additional information, including SUD and mental health records and informant interviews, to establish the connection between pregnancy-relatedness among suicide and unintentional overdose deaths.

These results suggest that MMRCs may consider working with policy makers to address barriers for systematically acquiring complete data sources from which to determine pregnancy-relatedness for suicides and unintentional overdoses. Depending on

interpretation, existing statutes (e.g., the Code of Federal Regulations, 42 USC § 290dd-2, 42 CFR Part 2 covering patient record confidentiality) may limit MMRC access to important mental health records. However, the statute states that "federal, state and local governmental agencies and third-party payers may conduct audits and evaluations to identify needed actions at the agency or payer level to improve care" (United State Department of Health & Human Services Office of the Secretary 2023). We suggest that state attorney general could issue statements to support MMRC access to SUD and mental health treatment records in order to facilitate review and development of recommendation to prevent future deaths. Additionally, MMRCs can consider incorporating informant interviews and systematic searches for additional information, such as social media posts, in their abstraction processes. Informant interviews, which can include verbal or psychological autopsies, have provided key information to decipher causes and circumstances leading to suicide and unintentional overdose deaths internationally (Iyer et al. 2013; Knoll and Hatters-Friedman 2015; Montgomery et al. 2011; Thacore and Varma 2000). These additional data sources may be particularly helpful in making evidence-based determinations in the late postpartum period. Finally, while we identified a set of consensus criteria, the results of the modified Delphi process also suggest the need for continuing iterative adaptation to help expand consensus criteria beyond those currently identified, especially in the late postpartum period.

A strength of this study is that we convened a large, geographically diverse group of participants representing most MMRCs. This geographic diversity supports the applicability of our results broadly to state and local MMRCs. Another strength is that our scenarios reflected real cases, which frequently have missing or incomplete information. However, this study is not without limitations. Not all MMRCs review suicide and unintentional overdose deaths, and some members of these committees may have little experience in applying the framework of establishing pregnancy-relatedness to these deaths. We specifically chose not to include racial and ethnic identifiers in our case scenarios to reduce potential reviewer bias; however, this precludes any analysis to assess the effect of inherent bias on determination of pregnancy-relatedness. Additionally, our defined early and late postpartum periods are different than more traditional cutoffs of 0–42-day and 43–365-day postpartum and do preclude comparison based on these definitions.

Based on the results of this modified Delphi process, we identified a set of criteria that can improve standardized identification of pregnancy-related suicide and unintentional overdose deaths by MMRCs. Use of these consensus criteria may lead to more comparable data across MMRCs, facilitating aggregation of these data at the regional and national level. Additional steps for supporting state and local MMRCs include promoting use of standardized tools to guide informant interviews and further development of criteria for the late postpartum period (Building U.S. Capacity to Review and Prevent Maternal Deaths 2019).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

This study was funded by the CDC Foundation Grant No. 6 NU38OT000288-03-01, as sub award from the Centers of Disease Control and Prevention Cooperative Agreement No. OT18-1802. The University of Utah receives funds to support Marcela C. Smid from Gilead Science Inc. for study on hepatitis C treatment in pregnancy and Jada device from Alydia/Organon Inc. REDCap platform is supported by University of Utah Center for Clinical and Translational Center 8UL1RR000105, formerly UL1RR025764 NCATS/NIH.

References

Barrios M, Guilera G, Nuño L, Gómez-Benito J (2021) Consensus in the Delphi method: what makes a decision change? Technol Forecast Soc Chang 163:120484. 10.1016/j.techfore.2020.120484

Bruzelius E, Martins SS (2022) US trends in drug overdose mortality among pregnant and postpartum persons, 2017–2020. Jama 328:2159–2161. 10.1001/jama.2022.17045 [PubMed: 36472602]

Building U.S. capacity to review and prevent maternal deaths. Informant interview guide for maternal mortality review committees. 2019. Available from: https://reviewtoaction.org/national-resource/informant-interview-guide-maternal-mortality-review-committees

Campbell KA, Olson LM, Keenan HT (2015) Critical elements in the medical evaluation of suspected child physical abuse. Pediatrics 136:35–43. 10.1542/peds.2014-4192 [PubMed: 26101359]

Campbell KA, Wood JN, Lindberg DM, Berger RP (2021) A standardized definition of near-fatal child maltreatment: results of a multidisciplinary Delphi process. Child Abuse Negl 112:104893. 10.1016/j.chiabu.2020.104893 [PubMed: 33373847]

Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM). Maternal mortality review facilitation guide version 12. 2021 [cited 2023 August 6th]. Available from: https://www.reviewtoaction.org/sites/default/files/2022-08/MMRC_Facilitation_Guide_V12.pdf

Fink A, Kosecoff J, Chassin M, Brook RH (1984) Consensus methods: characteristics and guidelines for use. Am J Public Health 74:979–983. 10.2105/ajph.74.9.979 [PubMed: 6380323]

Goldman-Mellor S, Margerison CE (2019) Maternal drug-related death and suicide are leading causes of postpartum death in California. Am J Obstet Gynecol 221:489.e1–489.e9. 10.1016/j.ajog.2019.05.045

Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG (2009) Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 42:377–381. 10.1016/j.jbi.2008.08.010 [PubMed: 18929686]

Iyer A, Sen G, Sreevathsa A (2013) Deciphering Rashomon: an approach to verbal autopsies of maternal deaths. Glob Public Health 8:389–404. 10.1080/17441692.2013.772219 [PubMed: 23485011]

Jones J, Hunter D (1995) Consensus methods for medical and health services research. Bmj 311:376–380. 10.1136/bmj.311.7001.376 [PubMed: 7640549]

Knoll JL, Hatters-Friedman S (2015) The homicide-suicide phenomenon: findings of psychological autopsies. J Forensic Sci 60:1253–1257. 10.1111/1556-4029.12819 [PubMed: 26259152]

Montgomery AL, Morris SK, Kumar R, Jotkar R, Mony P, Bassani DG, Jha P (2011) Capturing the context of maternal deaths from verbal autopsies: a reliability study of the maternal data extraction tool (M-DET). PLoS One 6:e14637. 10.1371/journal.pone.0014637 [PubMed: 21326873]

Murphy MK, Black NA, Lamping DL, McKee CM, Sanderson CF, Askham J, Marteau T (1998) Consensus development methods, and their use in clinical guideline development. Health Technol Assess 2:i-iv, 1–88

Nebraska Maternal Mortality Review Committee (2022) [cited 2022 November 18th]. Available from: https://dhhs.ne.gov/Pages/Maternal-Mortality-Review-Committee-(MMRC).aspx

Niederberger M, Spranger J (2020) Delphi technique in health sciences: a map. Front Public Health 8:457. 10.3389/fpubh.2020.00457 [PubMed: 33072683]

Petersen EE, Davis NL, Goodman D, Cox S, Mayes N, Johnston E, Syverson C, Seed K, Shapiro-Mendoza CK, Callaghan WM (2019) Vital signs: pregnancy-related deaths, United States, 2011–2015, and strategies for prevention, 13 states, 2013–2017. Morb Mortal Wkly Rep 68:423

Reviewtoaction.org. Definitions (2018) [cited 2022 July 8th]. Available from: http://www.reviewtoaction.org/learn/definitions

Schiff DM, Nielsen T, Terplan M, Hood M, Bernson D, Diop H, Bharel M, Wilens TE, LaRochelle M, Walley AY, Land T (2018) Fatal and nonfatal overdose among pregnant and postpartum women in Massachusetts. Obstet Gynecol 132:466–474. 10.1097/AOG.0000000000002734 [PubMed: 29995730]

Smid MC, Maeda J, Stone NM, Sylvester H, Baksh L, Debbink MP, Varner MW, Metz TD (2020a) Standardized criteria for review of perinatal suicides and accidental drug-related deaths. Obstet Gynecol 136:645–653. 10.1097/aog.0000000000003988 [PubMed: 32925616]

Smid MC, Schauberger CW, Terplan M, Wright TE (2020b) Early lessons from maternal mortality review committees on drug-related deaths-time for obstetrical providers to take the lead in addressing addiction. Am J Obstet Gynecol MFM 2:100177. 10.1016/j.ajogmf.2020.100177 [PubMed: 33345905]

Thacore VR, Varma SL (2000) A study of suicides in Ballarat, Victoria, Australia. Crisis 21:26–30. 10.1027//0227-5910.21.1.26 [PubMed: 10793468]

Trost SL, Beauregard JL, Smoots AN, Ko JY, Haight SC, Moore Simas TA, Byatt N, Madni SA, Goodman D (2021) Preventing pregnancy-related mental health deaths: insights from 14 US maternal mortality review committees, 2008–17. Health Aff (Millwood) 40:1551–1559. 10.1377/hlthaff.2021.00615 [PubMed: 34606354]

United State Department of Health & Human Services Office of the Secretary (2023) Confidentiality of substance use disorder patient records [cited 2023 August 7th]. Available from: https://www.federalregister.gov/documents/2020/07/15/2020-14675/confidentiality-of-substance-use-disorder-patient-records

United States Government Accountability Office Congressional Requesters. Maternal mortality: trends in pregnancy-related deaths and federal efforts to reduce them 2020 [cited 2023 August 7th]. Available from: https://www.gao.gov/assets/gao-20-248.pd

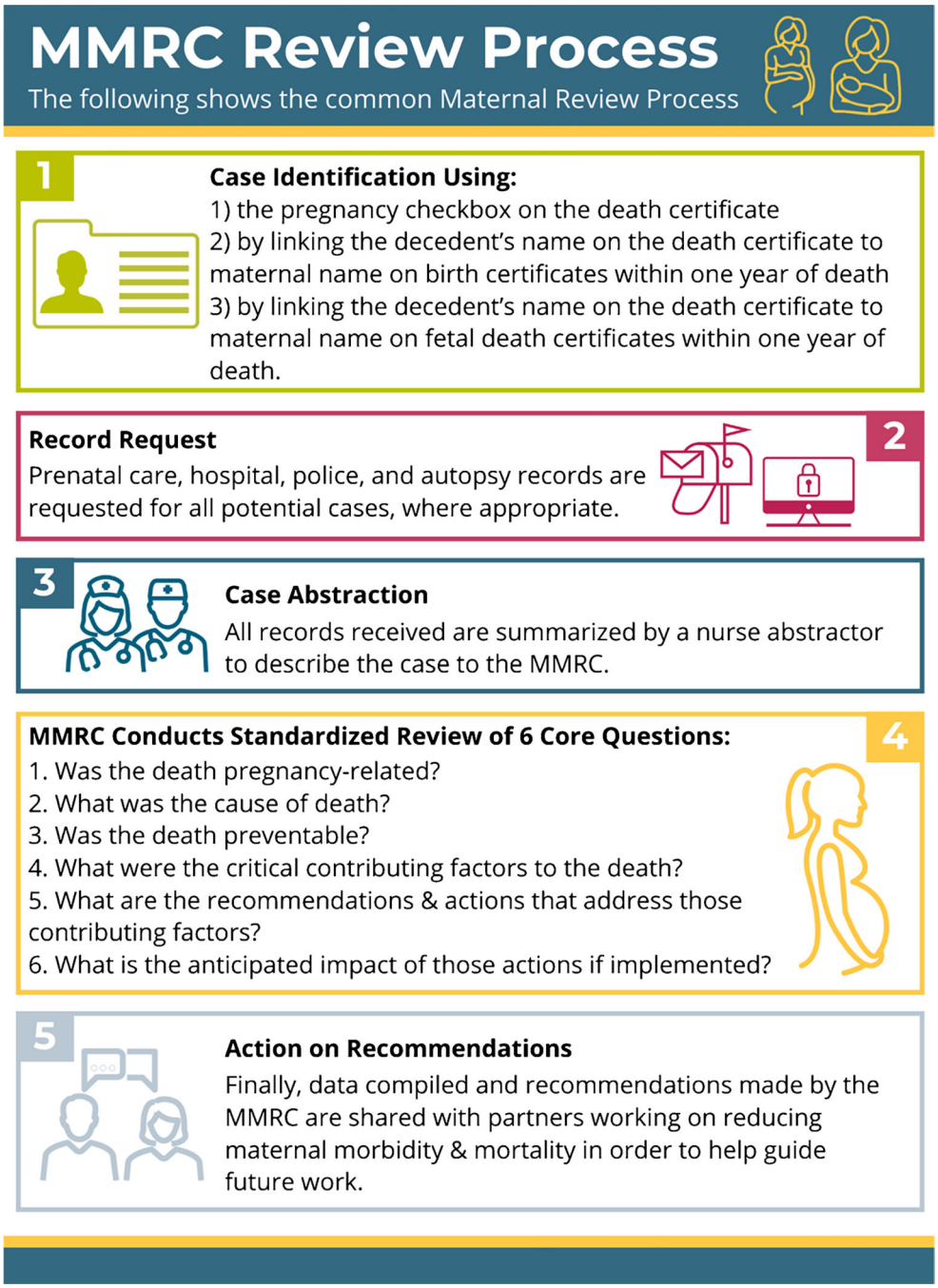

Fig. 1.

Maternal Mortality Review Committee (MMRC) process, adapted from Nebraska MMRC (Nebraska Maternal Mortality Review Committee 2022)

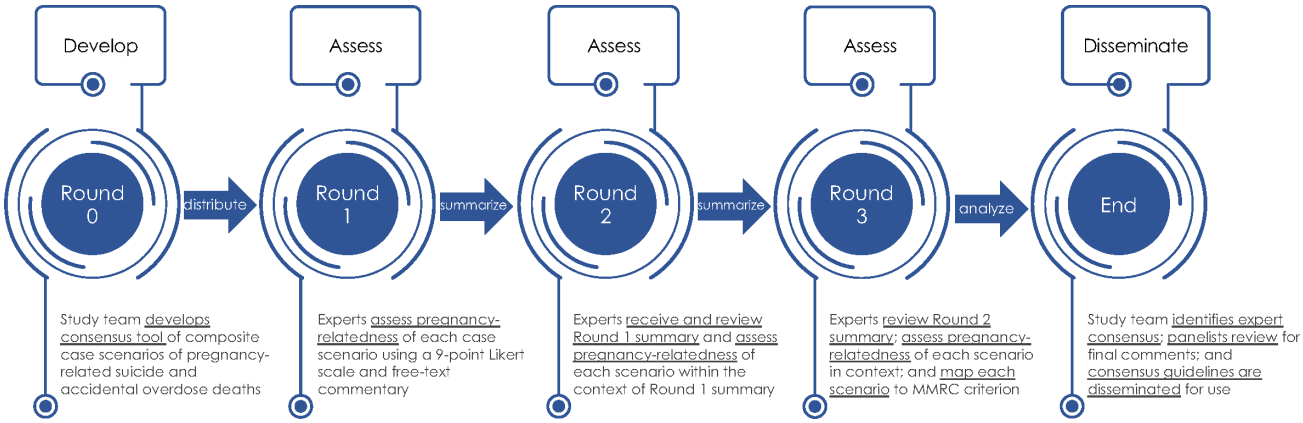

Fig. 2.

Description of modified Delphi process to identify consensus criteria for determining pregnancy-relatedness among suicide and unintentional overdose deaths

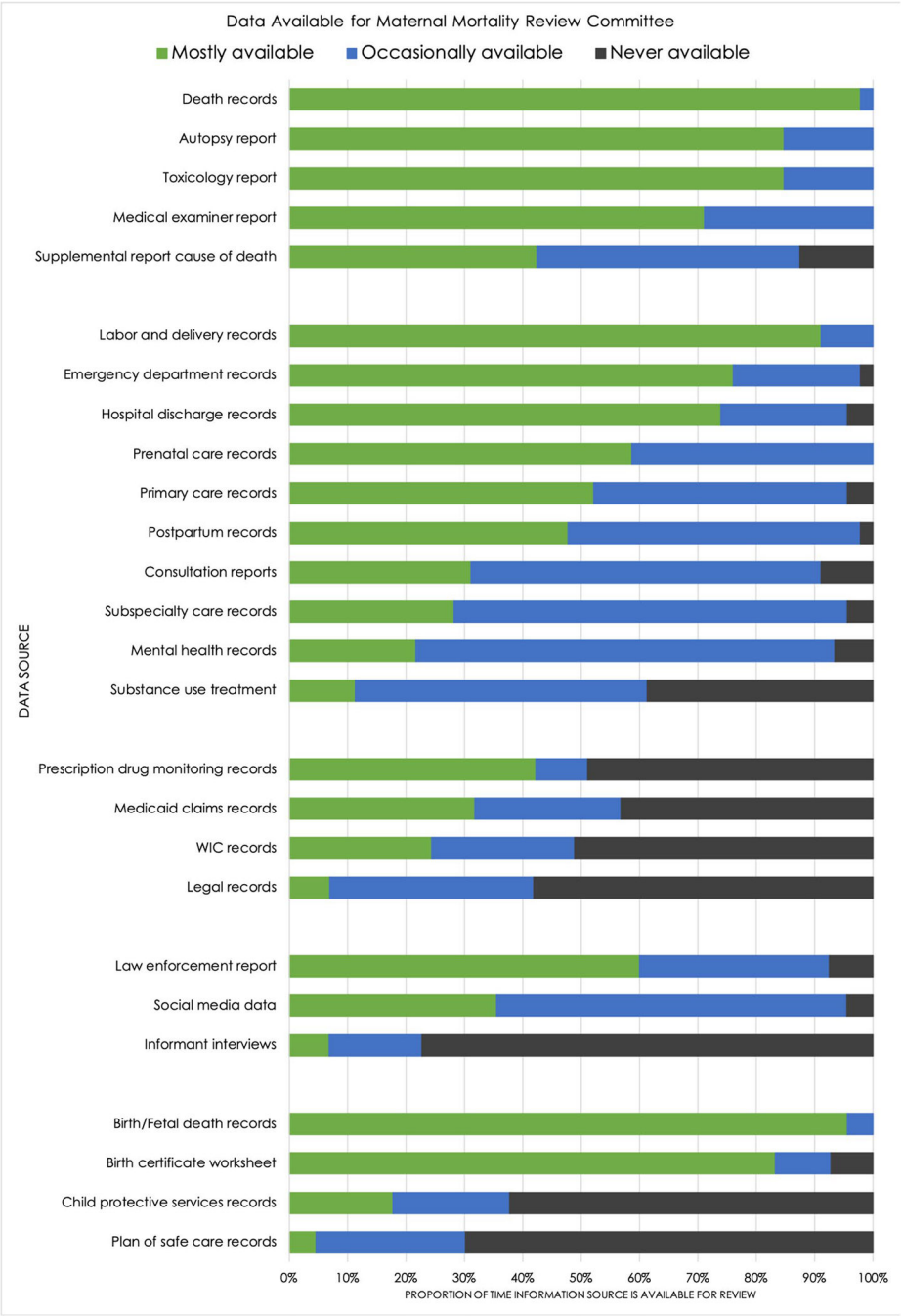

Fig. 3.
Frequency of data sources available to MMRCs as reported by MMRC Chairs

		Summary of Expert Consensus	Pregnancy*		Early postpartum*		Late postpartum*	
		Criteria	Base	Additional	Base	Additional	Base	Additional
Pregnancy complication	1a	Increased pain directly attributable to pregnancy or postpartum events leading to self-harm or drug use						
	1b	Traumatic event in pregnancy or postpartum with a temporal relationship between the event leading to self-harm or increased drug use						
	1c	Pregnancy-related complication likely exacerbated by drug use (peripartum, round 1)			Not applicable			
Chain of events initiated by pregnancy		Criteria						
	2a.1	Cessation or attempted taper of medications for pregnancy-related concerns of neonatal or fetal risk, leading to maternal destabilization or drug use						
	2a.2	Cessation or attempted taper of medications during pregnancy due to fear of Child Protective Service involvement, leading to maternal destabilization or drug use						
	2b	Inability to access inpatient or outpatient drug or mental health treatment due to pregnancy						
	2c	Perinatal depression, anxiety, or psychosis resulting in maternal destabilization or drug use						
Aggravation of underlying condition		Criteria						
	3a	Worsening of underlying depression, anxiety, or other psychiatric condition in pregnancy or the postpartum period with documentation that mental illness led to drug use or self-harm						
	3b	Exacerbation, undertreatment, or delayed treatment of pre-existing condition in pregnancy or postpartum leading to use of prescribed or illicit drugs						

* Cases were modified for each time point (prenatal, early postpartum defined as within 8 weeks postpartum, and late postpartum defined as within 6-12 months postpartum) and details were changed as appropriate.

Fig. 4.

Summary of participants' assessment of proposed criteria for determining pregnancy-relatedness among suicide and unintentional overdose deaths

Table 1

Case scenarios used to evaluate the criterion proposed for determining the pregnancy-relatedness of suicides and unintentional overdose deaths

Pregnancy-related criteria	Base case information	Timing*	Additional information from medical or death investigation	Additional information from non-medical sources
1. Pregnancy complication				
a. Increased pain directly attributable to pregnancy or postpartum events leading to self-harm or drug use that are implicated in suicide or unintentional drug-related death	Case 1a A 33-year-old woman died from a polysubstance overdose. On the morning of her death, her partner could not wake her. EMS was called and she was unresponsive to resuscitative measures Prenatal medical records One prior live birth, cesarean delivery for failure to progress Adequate prenatal visit with this pregnancy History of chronic back pain from a car accident Chronic pain specialist prescribed oxycodone, gabapentin, alprazolam, zolpidem, and sertraline Medical examiner report Cause of death: drug overdose Underlying: chronic pain Contributing: polysubstance use Toxicology: + for metabolites of oxycodone, gabapentin, alprazolam, zolpidem, and sertraline	• 32-week gestation • 7-week postpartum • 8-month postpartum	Prenatal records describe increasing back pain with pregnancy progression	Partner reports increasing back pain due to pregnancy
b. Traumatic event in pregnancy or postpartum (diagnosis of fetal anomaly, stillbirth, preterm delivery, neonatal or infant death, traumatic delivery experience, removal of children from custody) with a temporal relationship between the event leading to self-harm or increased drug use and subsequent death	Case 1b Case background A 25-year-old died of a heroin overdose. On the morning of her death, her partner could not wake her. EMS was called and she was unresponsive to resuscitative measures Prenatal medical records Two prior live births, 2 children adopted from foster care due to substance use disorder, chronic pain, and mental illness Inadequate prenatal care with this pregnancy, single visit at 22 weeks of gestation Self-disclosed current heroin use; positive urine toxicology for opiates Expressed concern for losing custody of another child after delivery Medical examiner report Cause of death: drug overdose Underlying: opioid use disorder Contributing: mental health disorder Toxicology: + for 6-acetylmorphine and morphine (metabolites of heroin) Child welfare (postpartum scenarios only) Infant was placed in foster care and had not been returned to her custody prior to her death	• 32-week gestation • 7-week postpartum • 8-month postpartum	None	Social media Prenatal scenario: posted within 3 hours of death. “I have no reason to live now that everything I love is going to be taken from me” Postpartum scenarios: “I have no reason to live now that everything I love has been taken from me”
c. Pregnancy-related complication likely exacerbated by drug use leading to subsequent death	Case 1c Case background 19-year-old primiparous woman died of postpartum hemorrhage after presenting for her first prenatal visit at 37 weeks Prenatal medical records Inadequate prenatal care presents for first prenatal care at 37 weeks had a sustained blood pressure of 170/100, a severe headache, and vaginal bleeding. Urine protein: creatinine ratio was 0.4 (all evidence of pre-eclampsia). Labs were otherwise unremarkable Labor and delivery records: Fetal heart tracing was non-reassuring	• Delivery	None	None

Pregnancy-related criteria	Base case information	Timing*	Additional information from medical or death investigation	Additional information from non-medical sources
	Rapid transition from 1- to 10-cm profuse vaginal bleeding, after vaginal delivery of infant and placenta with a very large retroplacental clot Postpartum uterine atony and severe postpartum hemorrhage that was non-responsive to uterotonics Coagulopathic, received multiple blood transfusions and underwent a hysterectomy for continued atony Unresponsive on the operating table and did not respond to intensive resuscitative efforts by the hospital code teams Urine toxicology positive for methamphetamine Medical examiner reports Cause of death: postpartum hemorrhage Underlying: placental abruption Contributing: pre-eclampsia			
2. Chain of events initiated by pregnancy				
a. Cessation or attempted taper of medications for pregnancy-related concerns (neonatal/fetal exposure risk, fear of Child Protective Service involvement) leading to maternal destabilization or drug use and subsequent death	Case 2a.1 Case background A 32-year-old multiparous woman is found deceased with a self-inflicted gunshot wound Prenatal medical provider Prior 29-week stillbirth, 2 live births On SSRI for depression for many years, stopped the SSRI at 28 weeks after OB reviewed potential neonatal risk EPDS at beginning of pregnancy was 8 with no thoughts of self-harm EPDS at 28 weeks was 14 with no thoughts of self-harm Labor and delivery (postpartum scenarios) Uncomplicated vaginal delivery at 38 weeks after spontaneous labor Seen by hospital social work, depression symptoms reviewed; advised to follow up with OB at 6 weeks Postpartum OB notes do not mention SSRI Medical examiner Cause of death: gunshot wound Underlying: depression Toxicology: negative	• 32-week gestation • 7-week postpartum • 8-month postpartum	A note found with decedent stating that she was sorry to her children and that they were better off without her because she was a “bad person for having thoughts of hurting them”	Partner reported that she had become increasingly anxious and depressed since stopping her medications, spending hours on websites about stillbirths and sudden infant deaths
a. Cessation or attempted taper of medications for pregnancy-related concerns (neonatal/fetal exposure risk, fear of Child Protective Service involvement) leading to maternal destabilization or drug use and subsequent death	Case 2a.2 Case background 29-year-old woman with history of opioid use disorder (OUD) stabilized on buprenorphine for 2 years. On the day of death, she was found unresponsive with a needle in her arm and tourniquet nearby. EMS was called but resuscitative efforts were unsuccessful Prenatal medical provider Two prior live births, placed in foster care due to parental substance use Appropriate prenatal care, with history of OUD and hepatitis C, stable on buprenorphine for 2 years OB provider noted that she was highly motivated to parent but worried about withdrawal symptoms in infant from buprenorphine and the risk of removal by Child Protective Services Labor and delivery (postpartum scenarios) No evidence of opioid use in third trimester; no evidence of withdrawal in infant Child welfare (postpartum scenarios) CPS contacted, providing in-home support services Medical examiner	• 32-week gestation • 7-week postpartum • 8-month postpartum	Prenatal medical record: she told her OB that she wanted to stop buprenorphine because she heard that “they take you baby away if you’re on those medications” Postpartum medical record (postpartum scenario only): she disclosed in her postpartum visit that she was	None

Pregnancy-related criteria	Base case information	Timing*	Additional information from medical or death investigation	Additional information from non-medical sources
	Cause of death: heroin use disorder Underlying: opioid use disorder Toxicology: positive for 6-acetylmorphine, a heroin specific metabolite (10.3 ng/mL) and morphine; negative for buprenorphine and norbuprenorphine (evidence for heroin, none for MOUD)		having cravings for heroin. The OB referred her back to her buprenorphine prescriber for management	
b. Inability to access inpatient or outpatient addiction or mental health treatment due to pregnancy	Case 2b Case background A 20-year-old woman with complex mental health history, including substance use disorder (heroin, cocaine, marijuana), died of drug overdose Prenatal medical record Two prior live births, adopted out of foster care due to parental substance use Ongoing substance use at her first prenatal visit at 14 weeks Enrolled in an outpatient methadone treatment program, requiring a 40-mile daily round trip, resulting in 2–3 days of missed dosing per week Requested residential treatment, but no programs accepting pregnant women with her insurance found within 300 miles of her home Labor and delivery record (postpartum scenarios) Vaginal delivery at 38 weeks after spontaneous labor complicated by maternal substance use disorder Infant monitored for withdrawal symptoms but did not require treatment Child welfare plan (postpartum scenarios) Plan of Safe Care set expectation for residential treatment No residential treatment programs within 300 miles would accept her insurance or mothers with infants She could not enter residential treatment and the infant was placed into foster care Medical examiner Cause of death: drug overdose Underlying: opioid use disorder, cocaine use disorder (contributing: mental health disorder) Toxicology: + for cannabinoids 2 ng/mL, oxycodone 91 mcg/L, morphine (free) 1.9 mg/L, and benzoylecgonine 908 ng/mL (cocaine metabolite)	• 32-week gestation • 7-week postpartum • 8-month postpartum	None	Police report: entries in the decedent's journal mentioned increasing despair at being unable to get into treatment and fear about effects of drugs on her baby but feeling she could not stop using and her only successful time with sustained recovery was in residential treatment Obituary website: post by her partner stated that the "state killed her by always taking our babies even after she asked for help"
c. Perinatal psychiatric conditions resulting in maternal destabilization or drug use and subsequent death	Case 2c Case background 24-year-old woman with onset of depression during pregnancy, associated with ambivalence over unplanned pregnancy. On the day of death, she was found by her roommate unconscious with empty bottle of anti-freeze and over-the-counter sleeping pills. EMS arrived and she was pronounced dead Prenatal medical record In a residential treatment program as teenager for depression Attended her first prenatal visit at 14 weeks and disclosed ambivalence about the pregnancy due to partner involvement but did not have enough money for termination of pregnancy At her 28-week visit, she had an EPDS of 19 (probable depression) with +1 on thoughts of self-harm. Provider notes no active plan for suicide and recorded depression as a new problem. Reviewed recommendation for SSRI and prescription was sent but never filled Labor and delivery record (postpartum scenarios) Uncomplicated vaginal delivery at 38 weeks after spontaneous labor Infant was placed for adoption Medical examiner Cause and manner of death: ethylene glycol poisoning, suicide	• 32-week gestation • 7-week postpartum • 8-month postpartum	None	Informant interview: her roommate said she had been wavering about placing the baby for adoption and that she had become increasingly depressed appearing over the last several months. Her roommate had encouraged her to discuss with her OB provider up to the day prior to her death

Pregnancy-related criteria	Base case information	Timing*	Additional information from medical or death investigation	Additional information from non-medical sources
	Underlying: depression Toxicology: negative			
d. Recovery/stabilization of substance use disorder achieved during pregnancy or postpartum with clear statement in records that pregnancy was motivating factor with subsequent relapse and subsequent death	Case 2d Case background 29-year-old woman with history of opioid use disorder (OUD) stabilized on buprenorphine for 2 years. On the day of death, she was found unresponsive with a needle in her arm and tourniquet nearby. EMS was called but resuscitative efforts were unsuccessful Prenatal medical record Two prior live births, placed in foster care due to parental substance use Appropriate prenatal care with a history of OUD and hepatitis C, stable on buprenorphine for 2 years Her partner had recently completed residential treatment program but was subsequently arrested on drug-related charges Labor and delivery record (postpartum scenario) Vaginal delivery at 38 weeks after spontaneous labor Pregnancy complicated by maternal substance use disorder, treated with buprenorphine Infant monitored for withdrawal symptoms but did not require treatment Medical examiner Cause of death: heroin use disorder. Underlying: opioid use disorder. Toxicology: positive for 6-acetylmorphine, a heroin specific metabolite (10.3 ng/mL), morphine, buprenorphine, and norbuprenorphine (evidence for heroin and MOUD)	• 32-week gestation • 7-week postpartum • 8-month postpartum	None	Informant interview: the family reported that decedent was committed to raising child in a 2-parent home. Although her partner had relapsed after treatment, she asked him to come back into the home to provide the child with a stable father figure and told her family that he was excited about being a dad. Despite this, the family had concerns that he “looked high like he always used to.” They suspected that he had continued to use drugs even after returning home
3. Aggravation of underlying condition by pregnancy				
a. Worsening of underlying depression, anxiety, or other psychiatric condition in pregnancy or postpartum period with documentation that mental illness led to drug use or self-harm and subsequent death	Case 3a Case background A 36-year-old woman with history of bipolar disorder was found hanging in her garage. She was declared dead on scene Prenatal medical provider History of bipolar disorder, stable on lithium but with prior suicide attempts when off medication. Prior to conception, she switched to lamotrigine Psychiatry records Monthly visits with psychiatrist, who managed medication change She had not been able to make her last 2 visits due to snowstorms and had called in refill requests (postpartum scenario only). Left request for appointment with psychiatrist 6-week postpartum, not scheduled and no further contact noted in available medical records Labor and delivery (postpartum scenario only) Uncomplicated vaginal delivery OB postpartum notes mention that her bipolar disease was well controlled Medical examiner Cause and manner of death: asphyxia, suicide Underlying: mental health disorder Toxicology: not available	• 32-week gestation • 7-week postpartum • 8-month postpartum	None	Police report: her partner reported that he had found her after receiving texts including “I’m sorry. I just can’t let our baby live with the same condition as me.” He noted on the police report that she had been more stable on lithium and the lamotrigine just did not work as well
b. Exacerbation, under-treatment or delayed treatment of pre-existing	Case 3b Case background 39-year-old woman with history of chronic abdominal pain as a complication of gastric	• 32-week gestation • 7-week	EMS report: “Partner reports that she’s been taking	

Pregnancy-related criteria	Base case information	Timing*	Additional information from medical or death investigation	Additional information from non-medical sources
condition in pregnancy or postpartum leading to use of prescribed or illicit drugs resulting in death, or suicide	bypass surgery. On the day of death, she was found unresponsive by her partner. EMS was called and gave several doses of naloxone. She died on route to hospital Prenatal medical records History of chronic abdominal pain after gastric bypass surgery Prior chronic pain provider deferred management during pregnancy OB referred patient to a new chronic pain provider OB provided oxycodone prescriptions to bridge until appointment Labor and delivery records (postpartum scenario) Uncomplicated vaginal delivery OB postpartum notes mention undertreated chronic pain Scheduled for next available with her previous chronic pain provider at 2-month postpartum Medical examiner Cause and manner of death: overdose, unintentional Underlying: gastrointestinal disorder Toxicology: + for acetaminophen, oxycodone, sertraline, trazadone, diphenhydramine	postpartum • 8-month postpartum	a lot more Tylenol because her pain is really bad but no one will treat her because she is pregnant”	
c. Medical conditions secondary to drug use in setting of pregnancy or postpartum that may be attributable to pregnancy-related physiology and increased risk of complications leading to death	Case 3c Case background 42-year-old woman brought to emergency room by EMS after she complained of headaches, then developed slurred speech and became unresponsive. The day after admission, she died within 2 hours of withdrawal of life support Prenatal medical records History of cocaine use disorder with many years of use Multiple admissions for abscesses and other infectious complications Three prior live births, no reported complications Labor, delivery, and postpartum records (prenatal death scenario) Vaginal delivery at 38 weeks after spontaneous labor (postpartum scenario only) On arrival to ED, her blood pressure was 180/100 No fetal heart tones noted on Doppler and fetal death was confirmed by OB team Urine screening toxicology was positive for cocaine metabolites CT scan showed large ischemic stroke, admitted to ICU Neurology evaluation identifies no normal brain activity Family decided to withdraw life support on day after presentation Medical examiner Cause of death: cerebral embolism Underlying: cocaine use Toxicology: + for benzoylecgonine 908 ng/mL (cocaine metabolite)	• 32-week gestation • 7-week postpartum • 8-month postpartum		Informant interview: her partner states that she had actually cut down on cocaine use due to the pregnancy but had recently used and then developed the headache

*Each base case was developed for 3 time points (prenatal or delivery, early postpartum defined as within 8-week postpartum, and late postpartum defined as within 6–12-month postpartum), and details were changed as appropriate for each time point listed

Table 2

Modified Delphi process participant characteristics, $N = 58$

Characteristic	
Age (median, IQR)	46.5 (39–57)
Race and ethnicity * (*n*, %)	
Asian	2 (3.5)
Black or African-American	4 (6.9)
Hispanic or Latinx	1 (1.7)
White	52 (89.7)
Maternal Mortality Review Committee service (*n*, %)	
Never	5 (8.6)
Past	2 (3.4)
Current, 0–5-year service	41 (70.7)
Current, ≥5-year service	10 (17.4)
Professional role * (*n*, %)	
Obstetric care	27 (46.5)
Public health/policy	22 (37.9)
Mental health or substance use expert	18 (31.0)
Medical examiner/coroner/pathology	2 (3.4)

* Participants could identify more than 1 race and ethnicity option

Table 3

Characteristics of Maternal Mortality Review Committees (MMRCs) participating in the modified Delphi process

Characteristic	*n* (%)
Number of participants in typical MMRC review	
≤20	10 (20.8)
21–30	23 (47.9)
31–40	8 (16.7)
≥41	7 (14.6)
Standing member of MMRC with specific expertise	
Maternal mental health	42 (87.5)
Substance use disorders	42 (87.5)
Annual number of pregnancy-associated deaths reviewed	
1–20	15 (31.3)
21–60	20 (41.7)
61+	9 (18.8)
Missing	4 (8.3)
Annual number of pregnancy-associated drug overdose deaths reviewed	
None	2 (4.2)
1–5	13 (27.1)
6–10	12 (25.0)
≥11	16 (33.3)
Missing	5 (10.4)
Annual number of pregnancy-associated suicide deaths reviewed	
None	7 (14.6)
1–5	29 (60.4)
6–10	3 (6.3)
≥11	5 (10.4)
Missing	4 (8.3)