

PREGNANCY-ASSOCIATED DEATHS IN CONNECTICUT

Data from Connecticut Maternal Mortality Review Committee, 2015-2019

December 2021

Connecticut
Department of Public Health



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Acknowledgements

Each medical record reviewed represents the death of a unique human being. The loss of a parent, partner, child, sibling, friend, or patient brings sadness to many people. The effort of the Connecticut Maternal Mortality Review Program is to honor those whose lives were lost and to promote healthy pregnancies and positive birth outcomes in the future.

We would also like to acknowledge the dedication of Connecticut Maternal Mortality Review Committee members, who volunteer their time and expertise to the review of pregnancy-associated deaths with the goal of identifying prevention strategies and facilitating their implementation.

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Gender Referencing:

CT MMRC strives to be inclusive of all birthing people and acknowledges that not all individuals who get pregnant or go through childbirth are cisgender women. The term “maternal” is used in this report for the sake of historical continuity and consistency with the published literature on this topic. The pronouns “they” and “their” are used throughout the report to refer to individuals in a gender-neutral manner.

Key Findings

This report summarizes the findings from the Connecticut Maternal Mortality Review Committee's (CT MMRC's) reviews of deaths that occurred between 2015 and 2019. During this period, there were 62 pregnancy-associated deaths. These were the deaths that occurred during pregnancy or within one year of the end of pregnancy regardless of the cause. Of 62 pregnancy-associated deaths, 25 (40.3%) were determined by CT MMRC to be pregnancy-related, which means that they were causally related to pregnancy or its management; 32 (53.2%) were determined to be pregnancy-associated but not pregnancy-related; and the Committee was not able to determine pregnancy-relatedness in four cases.

The Connecticut pregnancy-related mortality ratio (PRMR) for 2015-2019 was 14.2 per 100,000 live births. While this estimate exceeds the previously reported ratio of 10.3 per 100,000 live births for the period between 2015 and 2017, it is lower than the US PRMR of 16.7 per 100,000 births in for the period between 2007 and 2016.¹

The findings presented in this report are descriptive in nature and include breakdowns by decedents' medical and demographic background characteristics. In considering these breakdowns, it is important to keep in mind that they are based on a very small cohort. Slight changes in the counts could have resulted in very different percentages, thus painting a substantially different picture of maternal mortality in Connecticut.

Pregnancy-Associated Deaths

In the period between 2015 and 2019, there were 62 pregnancy-associated deaths of Connecticut residents. This includes deaths that occurred during pregnancy or within one year after the end of pregnancy *regardless of the cause*. In other words, some of these deaths were causally related to pregnancy or its management and others, such as, for example, some of the motor vehicle crashes and homicides, were not. Key facts pertaining to pregnancy-associated deaths in Connecticut in the period between 2015 and 2019 are as follows:

- ◆ There were 12-13 pregnancy-associated deaths per year, with a range between 8 and 18 deaths.
- ◆ There were, on average, 35,103 live births per year.
- ◆ Pregnancy-associated mortality ratio was 35.3 per 100,000 live births.
- ◆ White persons were underrepresented in the pregnancy-associated cohort (44% deaths v 53.8% live births), whereas Black persons were overrepresented (27% deaths v 13.1% live births). Latinx persons were neither over- nor underrepresented, accounting for 24% of pregnancy-associated deaths and for about 24.6% of live births.
- ◆ Persons who had Medicaid for insurance were overrepresented among pregnancy-associated deaths (68% deaths v 37% live births).

- ◆ Persons with at least a bachelor's degree were underrepresented among pregnancy-associated deaths (13% deaths v 45% live births).

Pregnancy-Related Deaths

In the period between 2015 and 2019, there were 25 pregnancy-related deaths of Connecticut residents. Pregnancy-related deaths are a subset of pregnancy-associated deaths that are *causally related to pregnancy or its management*. Key facts pertaining to pregnancy-related deaths in Connecticut in the period between 2015 and 2019 are as follows:

- ◆ There were, on average, 5-6 pregnancy-related deaths per year, with a range between 3 and 11 deaths.
- ◆ There were, on average, 35,103 live births per year.
- ◆ PRMR in 2015-2019 was 14.2 deaths per 100,000 live births, which is lower than the national estimate of 16.7 deaths per 100,000 live births in 2007-2016.¹
- ◆ CT MMRC's use of the Utah Criteria (standardized decision-making criteria for mental health-related deaths)² for the review of pregnancy-associated deaths that occurred in 2018 and 2019 likely contributed to a greater number of pregnancy-related deaths than would have been the case otherwise. In particular, there was an increase in pregnancy-related deaths due to substance use.
- ◆ Grouped together, Black persons were overrepresented among pregnancy-related deaths (20% deaths v 13% live births). Notably, the pregnancy-related mortality ratio was not computed for Black persons because of a small count of deaths (5 out of 25 pregnancy-related deaths).
- ◆ Persons who had Medicaid for insurance were overrepresented among pregnancy-related deaths (60% deaths v 37% live births).
- ◆ Persons who held a bachelor's degree or an advanced degree were underrepresented within the pregnancy-related cohort (20% deaths v 45% live births).
- ◆ Of those whose deaths that were pregnancy-related, over a quarter (28%) were service workers, one-fifth were sales workers (20%), and a handful (8%) occupied other work positions. One-fifth of the cohort included those who did not have outside employment, and only about a quarter (24%) included professionals.
- ◆ In the period between 2015 and 2019, 48% of pregnancy-related deaths occurred in the late postpartum period, between 43 and 365 days after the end of pregnancy.
- ◆ Just over half (56%) of pregnancy-related deaths occurred during inpatient hospital care (36%) or during hospital emergency visits (20%). Over one-third of deaths (36%) occurred in people's residences.
- ◆ Underlying causes of death were grouped into categories in accordance with CDC's guidelines,³ to protect people's privacy and to support analyses. The most frequent category, comprising 40% of pregnancy-related deaths in 2015-2019, was mental health conditions, including substance use disorder. Various medical disease categories accounted for over half (52%) of pregnancy-related deaths. These included cardiovascular and coronary conditions, hemorrhage, cerebral vascular accident, embolism, amniotic fluid embolism, and

pulmonary conditions. Additionally, one pregnancy-related death was an unintentional injury, and the underlying cause of death could not be determined in one instance.

- ◆ There were six suicides among pregnancy-related deaths.
- ◆ The CT MMRC began reviewing the contribution of discrimination to the death in November 2020, starting with deaths that occurred in 2018. The Committee determined that discrimination played or probably played a role in over two-thirds (71%) of pregnancy-related deaths in 2018-2019.
- ◆ Obesity contributed or probably contributed to 5 out of 25 pregnancy related deaths.
- ◆ 88% of pregnancy-related deaths were determined by CT MMRC to be preventable. In contrast, a Centers for Disease Control and Prevention (CDC) analysis of data from 14 state-based MMRCs reviewed between 2008 and 2017 showed that 65.8% of pregnancy-related deaths in those states (Arizona, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Louisiana, Mississippi, North Carolina, Ohio, South Carolina, Tennessee, and Utah) were preventable.⁴

CT MMRC Recommendations

CT MMRC's review of each preventable pregnancy-related death includes discussion about factors contributing to the death and articulation of recommendations for addressing contributing factors to prevent future deaths. The first set of official CT MMRC recommendations was issued on September 8, 2021, based on reviews of deaths that occurred between 2015 and 2017. These recommendations were included in CT MMRC's first annual report, in December 2020, and are re-printed here for the sake of reference:

- 1) Promote CDC's *Hear Her* communication campaign to obstetricians and other obstetrics providers (physician assistants, advance practice registered nurses, registered nurses, certified nurse midwives), hospital obstetrics units, and emergency departments.
- 2) Provide trainings to CT MMRC members on intimate partner violence.
- 3) Provide education to obstetric providers on available evidence-based screening tools for intimate partner violence, perinatal depression, and substance use disorder, and available resources.
- 4) Provide education in hospitals to emergency department staff and social work staff, as well as to obstetrics offices, on indicators of intimate partner violence.
- 5) Extend Medicaid coverage to one year postpartum.
- 6) Improve access to same day long-acting contraception in Federally Qualified Health Centers.

The second set of official CT MMRC recommendations was issued on October 7, 2021. These recommendations are based on the Committee's review of preventable pregnancy-related deaths that occurred between 2015 and 2019. Informed by a contextual multi-systemic framework, the official CT MMRC recommendations fall within five broad categories, as outlined below:

I. INCREASE PROVIDER EDUCATION

- 1) We recommend that the Connecticut Perinatal Quality Collaborative (CPQC) and Connecticut Hospital Association (CHA) offer, through the Alliance for Innovation on Maternal Health (AIM) Hypertension (HTN) bundle, provider training to increase awareness of health care needs, follow-up, and the significance of hypertensive disorders among pregnant and postpartum persons.
 - a. We recommend that CPQC and CHA provide obstetrics and gynecology providers with education about the importance of ensuring a referral to primary care providers, both during pregnancy and in the postpartum period, for persons with high blood pressure during pregnancy.
 - b. We recommend that CPQC and CHA educate primary care providers regarding the significance of high blood pressure during pregnancy and the importance of following up after delivery with patients who have high blood pressure during pregnancy.
- 2) We recommend that the Governor's Office coordinate the development of a web-based point of access portal for primary care providers and obstetrics and gynecology providers to refer patients to community resources such as, but not limited to, mental health treatment, substance use treatment programs, and home visiting programs.
- 3) We recommend that Connecticut State Medical Society (CSMS) and CHA provide training for emergency department providers to raise awareness on how to make referrals for substance use and mental health treatment for pregnant and postpartum persons.
- 4) We recommend that CHA in partnership with birth hospitals provide ongoing training to obstetrics and gynecology providers on appropriate treatment for substance use during pregnancy.
- 5) We recommend that CSMS and CHA in partnership with birth hospitals provide training to educate emergency department providers on the significance of Group A Strep in pregnant and postpartum persons.
- 6) We recommend that CSMS and CHA educate providers about checking prescription drug monitoring programs and patients' substance use history before prescribing opioids.

II. IMPROVE COORDINATION OF CARE AND COMMUNITY COLLABORATIVES

- 7) We recommend that the Human Services Committee, Women and Girl's Subcommittee propose a legislative mandate for all home visiting programs in Connecticut to enroll all birthing persons prenatally.
- 8) We recommend that the American College of Obstetricians and Gynecologists (ACOG) chapter in Connecticut provide ongoing training to educate obstetrics and gynecology providers about the importance of collaborating with home visiting programs to ensure outreach to pregnant persons when there is a lapse in prenatal care.
- 9) We recommend that the Office of Early Childhood (OEC) home visiting program conduct outreach to all obstetrics and gynecology providers to increase awareness about services offered through home visiting and how to refer patients.

III. DEVELOP MEDICAL CARE (PROVIDER) PROTOCOLS

- 10) We recommend that CT MMRC members lobby for an increased capacity of mobile crisis services to ensure 24/7 access.
- 11) We recommend that CPQC, CHA, and birth hospitals ensure, via AIM venous thromboembolism (VTE) bundle, that hospital discharge plans provide education to patients on the importance of mobility following cesarean sections, as well as risks associated with immobility, and that providers are prescribing and documenting the use of anticoagulation and pneumatic compression boots for birthing persons at risk of VTE, including persons who have had cesarean sections and those who have had prolonged immobility.
- 12) We recommend that CHA and hospitals work to flag all critical lab reports collected in emergency departments with panic values to ensure results are reported promptly to ordering providers and/or primary care providers.
- 13) We recommend that CT MMR Program staff develop a patient safety bundle for pregnant and postpartum persons with mental health disorders other than substance use disorder.

IV. IMPROVE CARE SYSTEMS (HOSPITAL) PROTOCOLS

- 14) We recommend that CPQC ensure all birth hospitals have a policy in place about when to consult with maternal-fetal medicine.
- 15) We recommend that CHA, hospitals, and physician offices work to implement policies about screening consistently for social determinants of health – including, at a minimum, intimate partner violence, perinatal depression, and adverse childhood experiences – at initial emergency department and obstetrics and gynecology visits, over the course of pregnancy, and in the postpartum period.
- 16) We recommend that CHA and hospitals ensure policies are in place to provide discharge summaries and discharge instructions to primary care physicians, pediatricians, and treating obstetrics and gynecology providers.

V. PROVIDE BROADER LEVEL (STATE AND COMMUNITY) SUPPORTS

- 17) We recommend that DCF provide support to all parents who are undergoing removal of a child and send a report to the patient's obstetric provider.
- 18) We recommend that hospital social workers be involved with cases where the child is being removed and develop a post-partum plan and send it to the obstetric provider.
- 19) We recommend that hospital social workers provide parents with contact information for therapists and counselors when there is consideration for child removal or a temporary hold on infant discharge.
- 20) We recommend that CT MMRC members lobby for increased inpatient psychiatric capacity in Connecticut.
- 21) We recommend that CT MMRC members lobby for congregate care housing for pregnant and postpartum persons with mental health disorders other than substance use disorder.

National Context

Data from maternal mortality review committees across the United States (US) show that majority of pregnancy-related deaths are preventable.³ Even so, the US official maternal mortality rate, as reported by the National Center for Health Statistics (NCHS), significantly increased in 2019 to 20.1 deaths per 100,000 live births.^{5, i} This places the US further from the Healthy People 2030 goal of reducing the 2018 baseline of 17.4 US maternal deaths per 100,000 live births to 15.7 by 2030.^{6, ii} The US Department of Health and Human Services (HHS) has set an even more ambitious goal for reducing maternal mortality in the US by 50% within 5 years, that is to 8.7 per 100,000 live births by 2025.⁷ More than ever, reaching either of these goals requires improving the quality of prenatal, perinatal, and postnatal care and increasing supports for pregnant and postpartum persons.

Health Disparities and Maternal Mortality

Primary risks to maternal health include high blood pressure, diabetes, unhealthy weight, infectious diseases, substance use disorder and other mental health conditions, and intimate partner violence, according to the Surgeon General's recent call to action.⁸ Social determinants of health impact all these factors, contributing to significant differences in maternal outcomes among subgroups based on social context, economic context, education, physical infrastructure, and healthcare context.⁹ Outcome differences based on race/ethnicity, income, and the relationship between race and income are particularly notable.^{1,9-17}

Between 2000 and 2018, 40-60% of health care measures in the US showed improvement across the domains of person-centered care, patient safety, healthy living, effective treatment, care coordination, and care affordability.⁹ The persistence of health care disparities, however, was indicated by 30-40% of all quality measures showing healthcare for people of color as worse than for white people during this same period.⁹

National data show considerable racial disparities in the risk of dying from complications of pregnancy.^{1,4,10,18-20} In the period between 2014 and 2017, pregnancy-related mortality ratios (PRMR) for Black and American Indian or Alaska Native persons were 41.7 and 28.3 per 100,000 live births, respectively.¹⁹ By contrast, PRMRs for Asian or Pacific Islander, white, and Hispanic or Latinx persons were 13.8, 13.4, and 11.6 per 100,000 live births, respectively, according to data from CDC's Pregnancy Mortality Surveillance System (PMSS).¹⁹

It bears noting that the rate for Black persons in 2014-2017 was 3 times the rate for White persons. What is more, this racial disparity is not a recent development. Studies conducted over the past decades have shown that the risk of dying from pregnancy-related complications has been consistently 3-4-fold higher for Black than for White persons,^{1,10,20-22} regardless of education and income.¹ PMSS estimates computed for the period between 2007 and 2016 show that risk for Black persons who held college or advanced degrees was 5.2 times the risk for their white counterparts and 1.6 times the risk for white persons with less than a high school diploma.¹ Furthermore, a recent ecological study showed that state-level income inequality was significantly associated

with pregnancy-related mortality among Black women, thus suggesting that “income inequality may contribute to the persisting racial inequality in maternal death.”¹⁶

Postpartum Care

Over half of pregnancy-related deaths in the US occur during the postpartum period. Between 2008 and 2017, about 18% of pregnancy-related deaths occurred 1-6 days after delivery; 19% occurred 7-42 days after delivery; and 24% occurred 43-365 days after delivery, according to the data from 14 state-based Maternal Mortality Review Committees (MMRCs).⁴ Postpartum, particularly 7-12 months from delivery, is also a period of high risk for deaths that are not necessarily causally related to pregnancy, such as those by homicide and drug overdose.²³

While prevention is heavily emphasized in the prenatal period, there is little attention to preventative care for women during the postpartum period.²⁴ In 2018, the American College of Obstetricians and Gynecologists (ACOG) called for redefining postpartum care from a single check-up to a process of comprehensive care over an extended period of 3-12 weeks after delivery.²⁵ The ACOG recommends that care during this “fourth trimester”²⁴ include, among other things, a visit within 3 weeks of delivery, a patient-tailored plan for care, and a comprehensive postpartum visit that includes a full assessment of physical, social, and psychological well-being.²⁵ Likewise, Healthy People 2030 objectives include increasing the number of women screened for depression during postpartum visits.⁶

One of the objectives of the US Health and Human Services Action plan to Improve Maternal Health is to “improve the quality and access to postpartum care, especially mental health and substance use services.”^{7,iii} This involves paying closer attention to mental health and substance use during postpartum, as well as developing strategies, such as extending Medicaid coverage to 365 days after birth, to close care gaps for all postpartum persons after pregnancy-related coverage expires. There are currently multiple state and federal bills proposing the expansion of Medicaid to cover maternal care for one year after delivery.²⁶

Substance Addiction, Mental Health, and Intimate Partner Violence

The Surgeon General’s Call to Action to Improve Maternal Health highlights the risks of substance use during pregnancy, noting the rise in opioid use in recent years and the fact that substance use disorder is often underdiagnosed.⁸ The report underscores the need for identification and effective treatment. It also emphasizes the importance of mental health conditions as a “common complication” during pregnancy and postpartum that may underlie suicide and overdose deaths. The Surgeon General’s Call further notes that women are particularly vulnerable to intimate partner violence (IPV) starting in, or increasing during, pregnancy and postpartum. Adverse outcomes include, among other things, a greater likelihood of depression, suicide, and homicide.⁸ Similarly, Healthy People 2030 emphasizes the importance of increasing abstinence from alcohol and illicit drugs among pregnant persons, highlighting the importance of screening those who are pregnant and referring them to treatment when needed.⁶

Connecticut Maternal Mortality Review Program

In 2018, the Connecticut General Assembly passed legislation granting authority to Connecticut Department of Public Health (DPH) to convene a multidisciplinary Maternal Mortality Review Committee (MMRC). By statute, CT MMRC was tasked with reviewing pregnancy-associated deaths of Connecticut’s residents; determining their preventability and relatedness to pregnancy; and developing actionable recommendations to prevent future deaths. The newly constituted CT MMRC held its first meeting in September 2018 and started reviewing cases under statutory protection in December 2018. The Committee’s first report, published in December 2020, reported on deaths that occurred between 2015 and 2017. The present report, the Committee’s second, builds onto the findings presented in December 2020 by reporting on pregnancy-associated deaths that occurred between 2015 and 2019.

There are three chief sources of information on pregnancy-associated deaths in the US. The first, the National Vital Statistics System, is used by the National Center for Health Statistics (NCHS) to compute the maternal mortality rate, based on information from death certificates.⁵ The maternal mortality rate is used to characterize maternal deaths, which are defined as “the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.”²⁷

The second system, CDC’s Pregnancy Mortality Surveillance System (PMSS), uses death certificates linked with birth or fetal death certificates. The data are reviewed and analyzed by medical epidemiologists to identify pregnancy-related deaths and to calculate the pregnancy-related mortality ratio (PRMR). Notably, the PRMR characterizes not maternal deaths, but rather, pregnancy-related deaths, which are defined as “the death of a woman while pregnant or within 1 year of the end of pregnancy from any cause related to or aggravated by the pregnancy.”¹⁹

The third system comprises state or local maternal mortality review committees such as CT MMRC. Data compiled by the CT MMR program for a review by CT MMRC provide the most comprehensive source of information on pregnancy-related deaths in the state. Like PMSS, the CT MMR program uses linked death and birth or fetal death certificates to identify pregnancy-associated deaths, to determine their relatedness to pregnancy, and to compute the PRMR. Unlike PMSS, the CT MMR program also relies on medical records, autopsy reports, police records, newspaper articles, obituaries, and social media postings to explore the circumstances of each death. This approach allows for not only descriptions of trends but also identification of contributing factors, and therefore, development of recommendations for action to prevent future deaths. The present report contains analyses of data assembled by the CT MMR program and created by CT MMRC in their review of pregnancy-associated deaths.

CT MMRC is multidisciplinary committee whose members represent a variety of clinical and non-clinical disciplines. On the clinical side, these include cardiology, emergency medicine, maternal-fetal medicine,

midwifery, nursing, pathology, obstetrics and gynecology, pediatrics, psychiatry, and public health; on the non-clinical side, the represented disciplines include community health work, domestic violence services, home visiting, psychology, and social work. Additionally, representatives from the Connecticut Department of Children and Families (DCF) and the Department of Mental Health and Addiction Services (DMHAS) serve on the Committee.

CT MMRC meetings are convened by the CT MMR program, which is situated within CT DPH. In addition to organizing CT MMRC meetings, the CT MMR program is responsible for the following:

- 1) identifying all deaths of Connecticut residents that occur during pregnancy or within one year after the end of pregnancy, in collaboration with the CT DPH Surveillance Analysis and Reporting (SAR) unit;
- 2) collecting data on the circumstances of each death;
- 3) abstracting all relevant data and compiling detailed case narratives;
- 4) enter all data into CDC's standard data system (Maternal Mortality Review Information Application, or MMRIA for short);
- 5) conducting quality assurance processes to ensure data quality, completeness, and timeliness;
- 6) analyzing and reporting on the data to inform policy and practice; and
- 7) working with key partners to implement the CT MMRC recommendations.

A detailed description of the CT MMR program and CT MMRC's meetings is provided in [Appendix A](#). Briefly, in accordance with CDC's guidelines, CT MMRC uses the *Committee Decisions Form*²⁸ as an organizing principle for the review of pregnancy-associated deaths. Each discussion starts with a co-chair reading the case narrative aloud, followed by Committee members' questions and an exchange of opinions. The CSMS co-chair then guides the conversation toward decision-making on three key questions:

- 1) what was the underlying cause of death?
- 2) was the death pregnancy-related?
- 3) was the death preventable?

Besides voting on the three key questions, the Committee reviews and votes on factors that may have contributed to the death—obesity, discrimination, mental health conditions, and substance use disorder—and, for non-natural deaths, the manner of death (ie, suicide, homicide, accident). For deaths that are determined to be preventable and pregnancy-related (ie, causally related to pregnancy), case discussion covers three additional key questions:

- 4) what were the contributing factors to the death?
- 5) what are the recommendations and actions that address those contributing factors?
- 6) what is the anticipated impact of those actions if implemented?

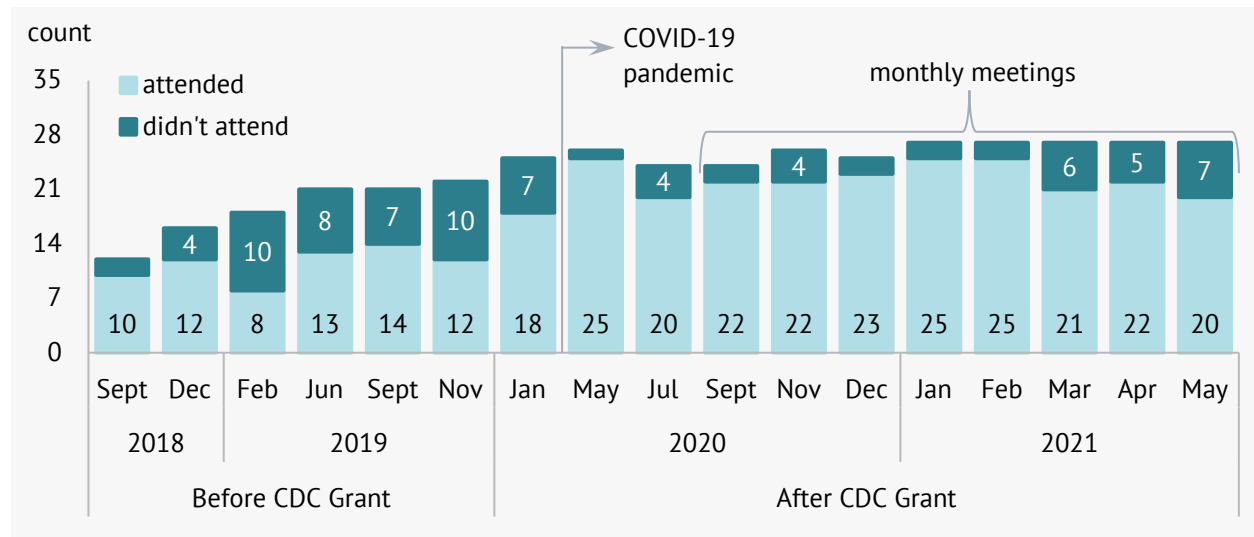
Answers to these and all other questions are recorded on the CDC’s *Committee Decisions Form* and entered into MMRIA, the CDC’s data system for monitoring maternal mortality in the US, within a week after each CT MMRC meeting.

As noted previously, CT MMRC was assembled in September 2018, with 12 members. Over the following three years, the Committee’s membership more than doubled, with 27 members in May of 2021, when the review of deaths that occurred in 2019 concluded. Figure A-1 shows a list of CT MMRC meetings that were held since September 2018; changes over time in the total count of members; and attendance at each meeting. In considering Figure A-1, two things are worth pointing out. First, there was a four-month hiatus in Committee meetings between January and May of 2020 because of the coronavirus (COVID-19) pandemic. In keeping with Connecticut Governor Lamont’s executive orders to encourage social distancing, CT MMRC meetings from May 2020 onward have been virtual, held via a web-based platform. Second, between September 2020 and May 2021, CT MMRC held monthly meetings in an effort to reduce the time lag between the occurrence of each maternal death and its review. Each meeting was three hours long, and all were held in the evenings to accommodate the work schedules of Committee members who volunteer their time and expertise for the benefit of Connecticut’s families.

FIGURE A-1

CT MMRC races to close the death-to-review lag

Between September 2020 and May 2021, CT MMRC held monthly meetings in an effort to reduce the time lag between the occurrence of each maternal death and its review

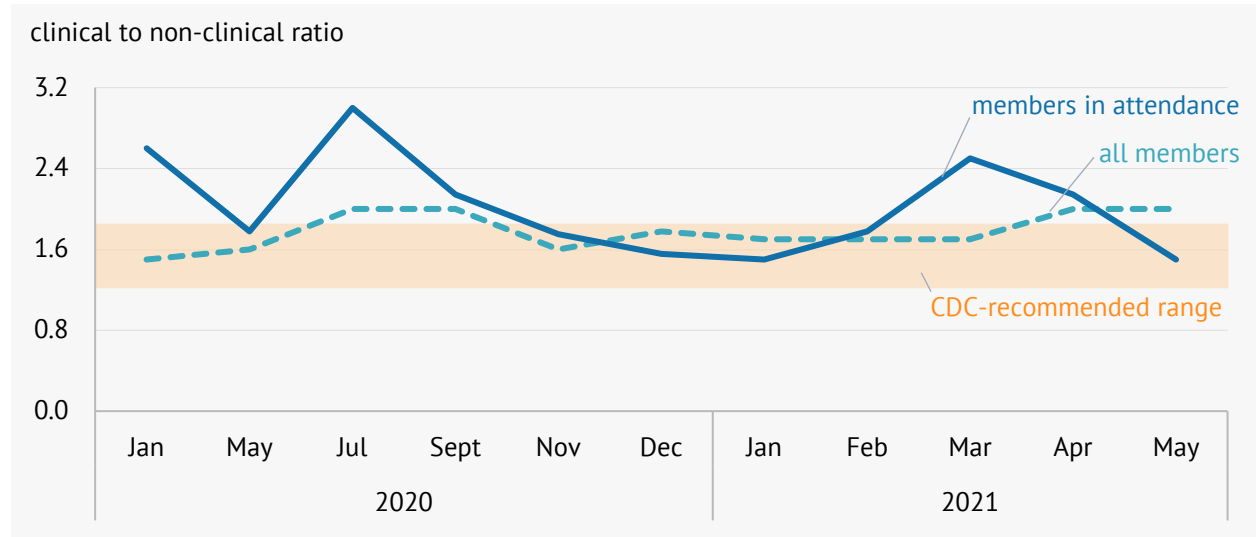


The ratio of clinical to non-clinical CT MMRC exceeded the CDC-recommended ratio of 60:40 at most points in time but was often within the recommended range (Figure A-2). In the period after September 2020 (since the first annual report), the ratio of clinical to non-clinical members has fluctuated between 1.6 and 2.0. Among those actually in attendance, the ratio has fluctuated between 1.5 and 2.5.

FIGURE A-2

There are more clinical than non-clinical members at each meeting

The ratio of clinical to non-clinical CT MMRC members mostly stayed in the recommended range

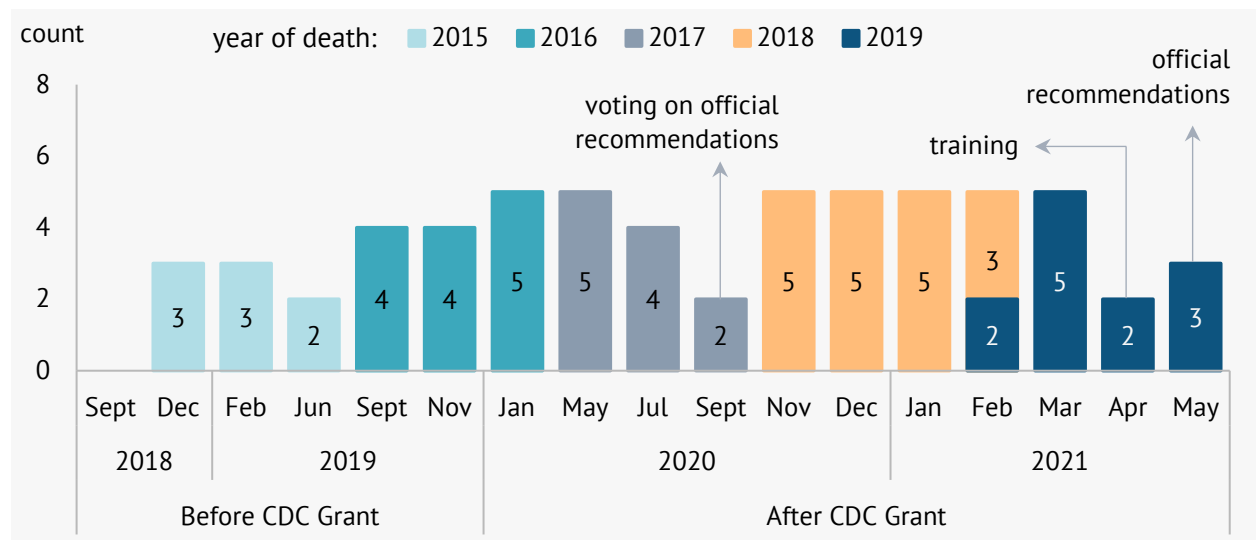


CT MMRC reviewed five deaths at each meeting held between November 2020 and March 2021 (Figure A-3). Two deaths were reviewed in April 2021, and the remainder of the meeting was devoted to a training on systemic racism. The meeting in May 2021 included 3 case discussions and it also incorporated the development of official CT MMRC recommendations based on the deaths that occurred in between 2015 and 2019.

FIGURE A-3

The death-to-review lag is shrinking

Average number of weeks between the time a death has occurred and its review by CT MMRC



During the seven meetings that were held between November 2020 and May 2021, CT MMRC reviewed a total of 30 deaths: all deaths that occurred in 2018 and all that occurred in 2019. It took, on average, 88 weeks for each death that occurred in 2019 to be reviewed by CT MMRC (Figure A-4; Figure A-5).

FIGURE A-4

The death-to-review lag is shrinking

Average number of weeks between the time a death has occurred and its review by CT MMRC

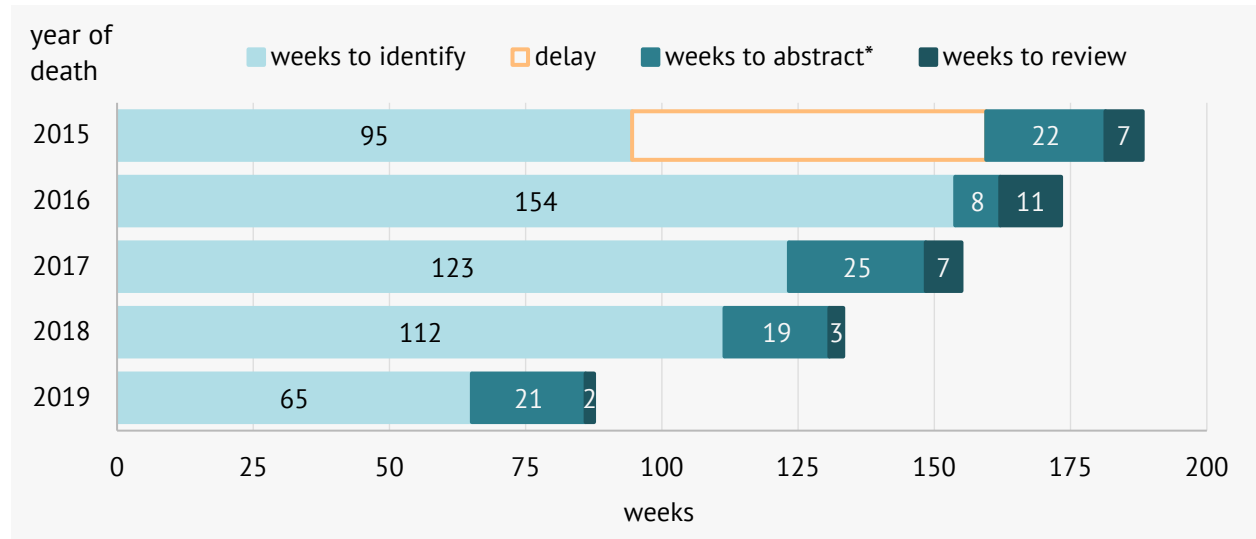
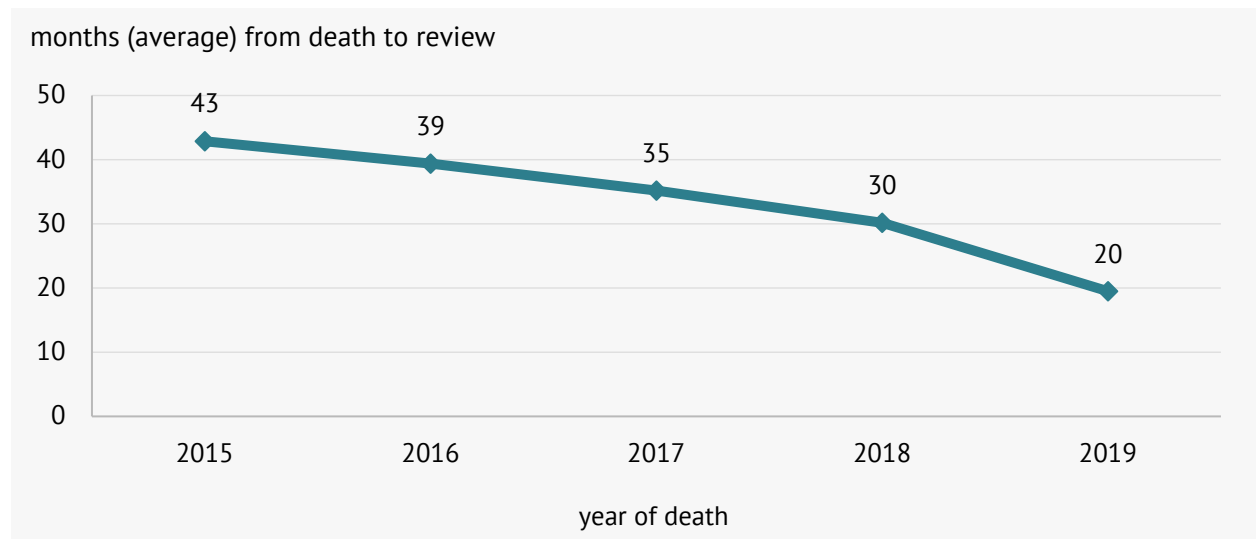


FIGURE A-5

CT is on target to meet CDC’s goals for maternal mortality reviews

Average number of months between the time a death has occurred and its review by CT MMRC



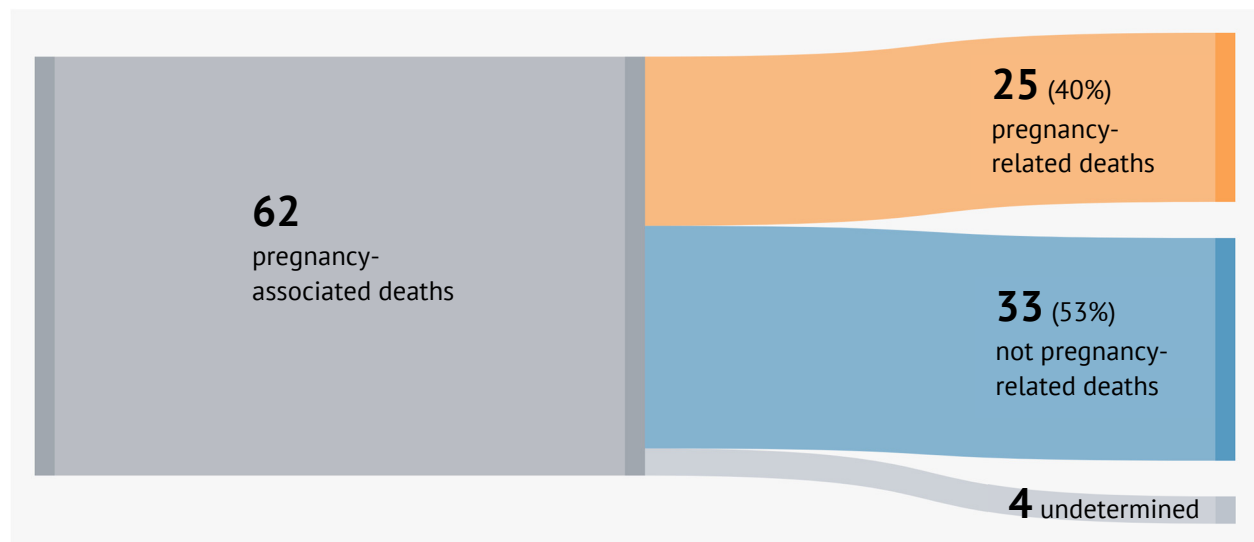
Findings

Pregnancy-associated deaths bear a temporal relationship to pregnancy: all deaths that occur during pregnancy or within one year of the end of pregnancy, regardless of the cause, are considered pregnancy-associated. There are three subsets within this category. The first subset includes deaths from “a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.”²⁹ These deaths are known as pregnancy-related. Some examples include deaths from pregnancy complications such as amniotic fluid embolism, infection, or hemorrhage; deaths from chains of events initiated by pregnancy such as postpartum depression ending in a suicide; and deaths from the aggravation of unrelated conditions, such as malignancies, by the physiologic effects of pregnancy. The second subset includes deaths from causes unrelated to pregnancy; these are known as pregnancy-associated but not pregnancy-related deaths. The last subset includes deaths for which MMRCs are unable to determine whether they are pregnancy-related or not pregnancy-related.

Between 2015 and 2019, there were 62 pregnancy-associated deaths among Connecticut residents. About four in ten of those deaths, a count of 25, were determined by the CT MMRC to be pregnancy-related; about five in ten of pregnancy-associated deaths, a count of 33, were determined to be not pregnancy-related; and determination of pregnancy-relatedness could not be made in four cases. The proportion of pregnancy-associated deaths in 2015-2019 that were determined by CT MMRC to be pregnancy-related exceeds the historic findings of MMRCs in other parts of the US. Namely, in the period between 2008 and 2017, about one-third of pregnancy-associated deaths in 14 US states were determined to be pregnancy-related.⁴

FIGURE B-1

Pregnancy-related deaths are a subset of pregnancy-associated deaths



Each year between 2015 and 2019, there were between eight and 18 pregnancy-associated deaths of Connecticut residents. The number of pregnancy-related deaths—a subset of pregnancy-associated deaths that are causally related to pregnancy or its management—ranged between three and five in 2015, 2016, 2017, and 2019, and spiked to 11 in 2018. During the period between 2015 and 2019, the mortality ratio was 35.3 for all pregnancy-associated deaths among Connecticut residents and 14.2 for the subset of deaths that were pregnancy-related (Table B-1). Because these ratios are based on a small number of deaths, they are subject to large random variation; hence, a range of possible values is provided alongside each ratio (see [Appendix C](#)).

TABLE B-1

About 4 in 10 pregnancy-associated deaths were pregnancy-related

Of 62 pregnancy-associated deaths, 25 were determined to be pregnancy-related

	Count					Count 2015-19	Ratio* 2015-19	95% CI**	
	2015	2016	2017	2018	2019			LL	UL
all pregnancy-associated	8	13	11	18	12	62	35.3	27.1	45.3
pregnancy-related	3	5	3	11	3	25	14.2	9.2	21.0
not pregnancy-related	3	8	8	7	7	33	--	--	--
undetermined	2	0	0	0	2	4	--	--	--

Note: *per 100,000 live births. **95% exact Poisson confidence interval.

Application of the Utah Criteria

Starting with deaths that occurred in 2018, CT MMRC began applying standardized decision-making criteria—known as the Utah criteria—to the review of perinatal suicides and accidental drug-related deaths.² The criteria were developed by the Utah Perinatal Mortality Review Committee in 2015 to assist with determinations of pregnancy-relatedness in cases in which mental health conditions and substance use disorder contributed to the death (see [Appendix B](#)). Consistent with CDC’s definition of pregnancy-relatedness, the criteria encompass 1) the effect of pregnancy complications on a person’s mental health, leading to self-harm or drug use; 2) the chain of events initiated by pregnancy such as, for example, depression arising in pregnancy or the postpartum and resulting in self-harm or drug use; and 3) aggravation of underlying condition by pregnancy such as, for example, the worsening of underlying depression in pregnancy or the postpartum, leading to self-harm or drug use.²

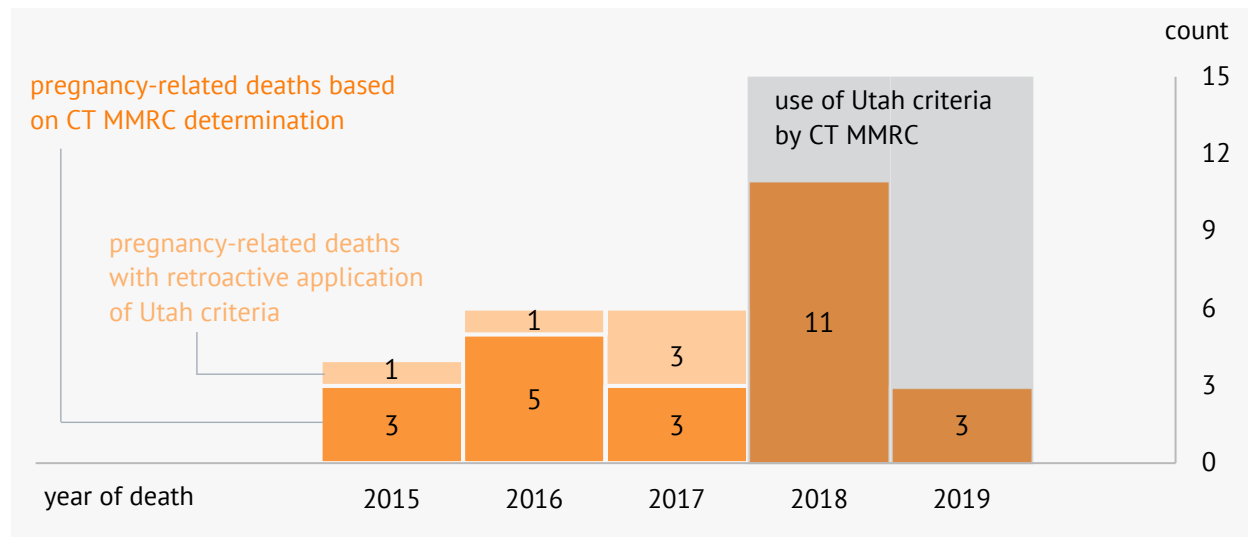
Based on the Utah criteria, CT MMRC determined six deaths that occurred in 2018 and two deaths that occurred in 2019 to be pregnancy-related. To explore the impact of the Utah criteria on CT MMRC’s decision-making, CT MMR project evaluators retrospectively reviewed all pregnancy-associated deaths prior to 2018, using the Utah criteria as a decision-making tool (see [Appendix C](#)). They found that five deaths that occurred in 2015-2017, and were determined by CT MMRC to be not pregnancy-related, met the Utah criteria for pregnancy-relatedness.

Furthermore, prior to the adoption of the Utah criteria, CT MMRC determined all three suicides and none of the substance use-related deaths that occurred in 2015-2017 to be pregnancy-related. After the adoption of the Utah criteria, CT MMRC determined all three suicides and close to half of all substance use-related deaths ($n = 5/11$) that occurred in 2018-2019 to be pregnancy-related. Along with the retrospective review of 2015-2017 deaths by CT MMR evaluators, these findings suggest that the use of the Utah criteria by CT MMRC likely contributed to a greater number of pregnancy-related determinations for deaths that occurred in 2018-2019 than would have been the case otherwise (Figure B-2).

FIGURE B-2

The Utah criteria changed CT MMRC’s decision-making

CT MMRC determined that there were between 3 and 5 pregnancy-related deaths per year in 2015-2017. Had the Utah criteria been applied to the review of these deaths, the count might have been higher, likely between 4 and 6 deaths per year in 2015-2017.



Disparities

Among all pregnancy-associated deaths in 2015 through 2019, over four in ten were those of White persons ($n = 27, 44\%$). Black persons accounted for over a quarter of pregnancy-associated deaths ($n = 17, 27\%$); Latinx persons another quarter ($n = 16, 26\%$); and there were two deaths of persons of other racial/ethnic backgrounds. Considering the subset of pregnancy-associated deaths that were pregnancy-related (that is, causally related to pregnancy or its management), over half were those of White persons ($n = 13, 52.0\%$); this was followed by six deaths of Latinx persons, five of Black persons, and one death of a person with another racial/ethnic background.

A comparison of all pregnancy-associated deaths in 2015 through 2019 to live births^{iv} during the same time period shows an underrepresentation of White persons (44% pregnancy-associated deaths v 54% live births) and an over-representation of Black persons (26% pregnancy-associated deaths v 13% live births). Within the

subset of pregnancy-associated deaths that were pregnancy-related, there was a slight underrepresentation of White persons (52% pregnancy-related deaths v 54% live births) and an overrepresentation of Black persons (20% pregnancy-related deaths v 13% live births) (Table B-2; Figure B-3).

TABLE B-2

Racial disparities persist among pregnancy-associated deaths

Of 62 pregnancy-associated deaths, 25 were determined to be pregnancy-related

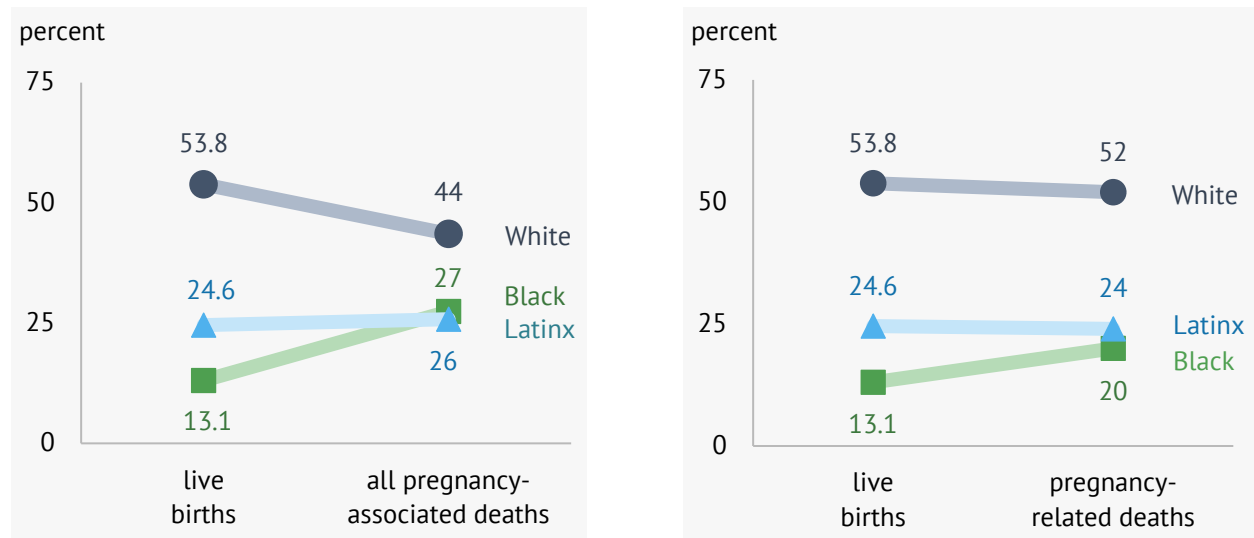
Race/Ethnicity	Live Births 2015-2019*		All Pregnancy-Associated Deaths 2015-2019		Pregnancy-Related Deaths 2015-2019	
	Count	Percent	Count	Percent	Count	Percent
Asian	12,719	7.2	--	--	--	--
Black	22,910	13.1	17	27.4	5	--
Latinx	43,145	24.6	16	25.8	6	--
White	94,481	53.8	27	43.5	13	52.0

Note: The category of "Latinx" does not include those who identified as Asian, Black, Native American, Pacific Islander, or White.

FIGURE B-3

Black persons are overrepresented among pregnancy-associated deaths

Black persons accounted for 13% of live births in Connecticut in 2015 through 2019 but almost 26% of all pregnancy-associated deaths. Black persons were also overrepresented (20% deaths v 13% live births) among the subset of pregnancy-associated deaths that were pregnancy-related.



Note: The category of "Latinx" does not include those who identified as Asian, Black, Native American, Pacific Islander, or White.

The proportion of Latinx persons was slightly greater among pregnancy-associated deaths (27%) than among live births (25%), but not within a subset of pregnancy-associated deaths that were pregnancy-related (24%), as shown on Figure B-3. Mortality ratios were not computed for racial/ethnic subgroups because of a small number of deaths.

Connecticut's considerable income inequality³⁰ likely contributes to the state's health disparities and is reflected in the data collected by the CT MMR program. In 2015, the state ranked third in the nation in income inequality, with the top 1% of families earning, on average, 37.2 times as much as the bottom 99% of families, according to a report by Economic Policy Institute.³⁰ Only two states, New York and Florida, had greater income inequality than Connecticut in 2015.³⁰ Connecticut's income inequality increased by 18% between 2007 and 2019, according to the America's Health Rankings 2020 annual report.³¹ Connecticut's health disparities are reflected in, and exacerbated by, the disproportionate number of uninsured residents of color and residents living in low-income neighborhoods.³² This is compounded by nearly 10% of Connecticut's neighborhoods being categorized as food and medical deserts.³²

Individual or household income data were not collected by the CT MMR program. However, the intersection of decedents' education, health insurance, and occupation points to limited economic resources, and more broadly, socioeconomic marginalization as a risk factor for mortality in Connecticut. Among those whose deaths were pregnancy-associated, about two-thirds had Medicaid for insurance ($n = 42$, 67.7%); roughly one quarter had private insurance ($n = 15$, 24.2%); and insurance was unknown for five persons, all of whom died during pregnancy. Within the subset of pregnancy-associated deaths that were pregnancy-related, six out of ten persons had Medicaid for health insurance ($n = 15$, 60%) and four out of ten persons had private insurance ($n = 10$, 40%). Regarding education, few had a college degree: only eight of those whose deaths were pregnancy-associated and five of those whose deaths were pregnancy-related held a bachelor's or an advanced degree (Figure B-4).

To be clear, Connecticut's pregnancy-associated deaths occurred to those with private insurance as well as those with public insurance. These deaths also occurred across all levels of education. However, most deaths occurred to those who had public insurance ($n = 42$, 68%) and to those who had a high school degree ($n = 27$, 43.5%) or had taken some college classes but did not have a college degree ($n = 13$, 21.0%). A similar pattern, though less pronounced, was observed among the subset of deaths that were pregnancy-related. Along these lines, it is noteworthy that, relative to live births in Connecticut, persons with Medicaid for health insurance were overrepresented among those whose deaths were pregnancy-associated (68% pregnancy-associated deaths v 37% live births) and among the subset of those whose deaths were pregnancy-related (60% pregnancy-related deaths v 37% live births (Figure B-5). By contrast, persons with at least a bachelor's degree were underrepresented among pregnancy-associated deaths (13% pregnancy-associated deaths v 45% live births) and among pregnancy-related deaths (20% pregnancy-related deaths v 45% live births).

FIGURE B-4

Most had limited economic and educational resources

Medicaid insurance (■) was used to pay for delivery (or prenatal care) by over two-thirds of those whose deaths were pregnancy-associated and 60% of those whose deaths were pregnancy-related. Only 13% of those whose deaths were pregnancy-associated and 20% of those whose deaths were pregnancy-related held a bachelor's degree or an advanced degree (■).

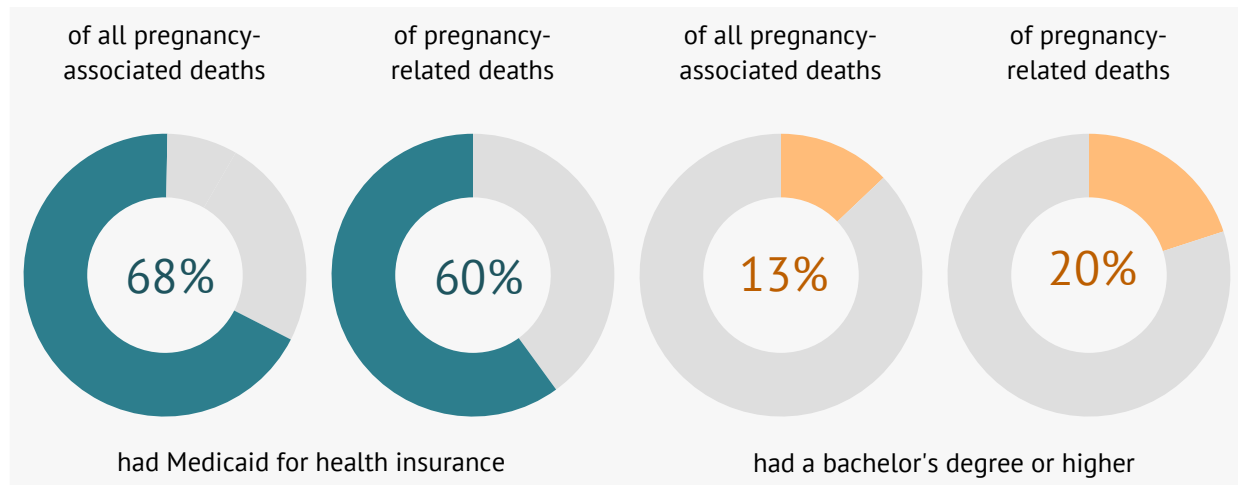
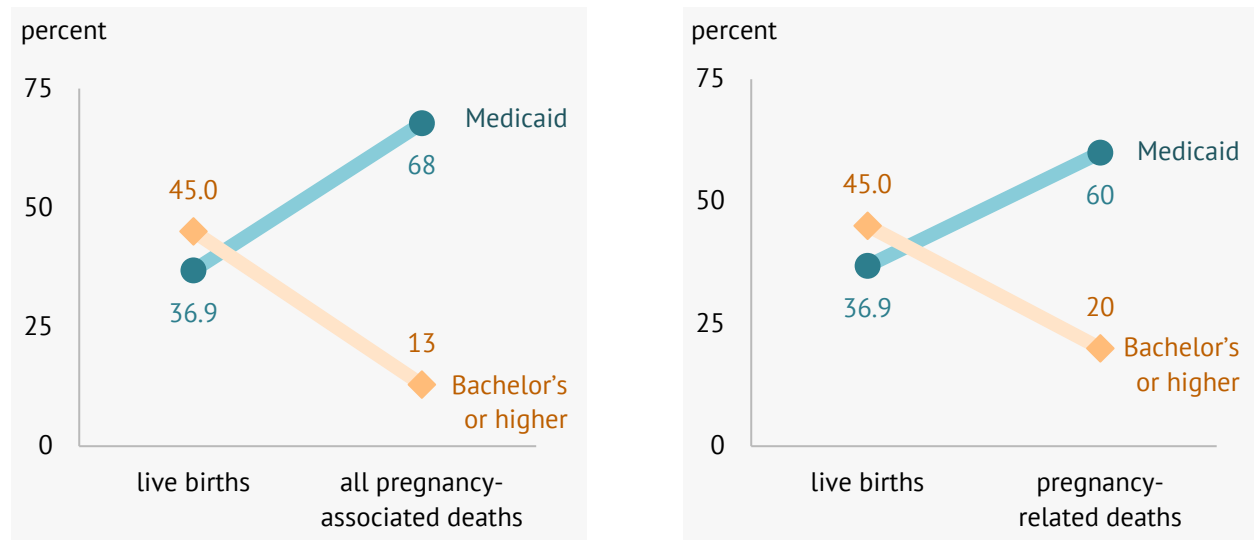


FIGURE B-5

Those with limited socioeconomic resources were overrepresented

Those with Medicaid (■) insurance were overrepresented and those with at least a bachelor's degree (■) were underrepresented. The same was true for the subset of deaths that were pregnancy-related.



Both health care insurance and education may reflect social class, and therefore socioeconomic marginalization, particularly when considered in relation to each other and in relation to employment (Figure B-6). All of those

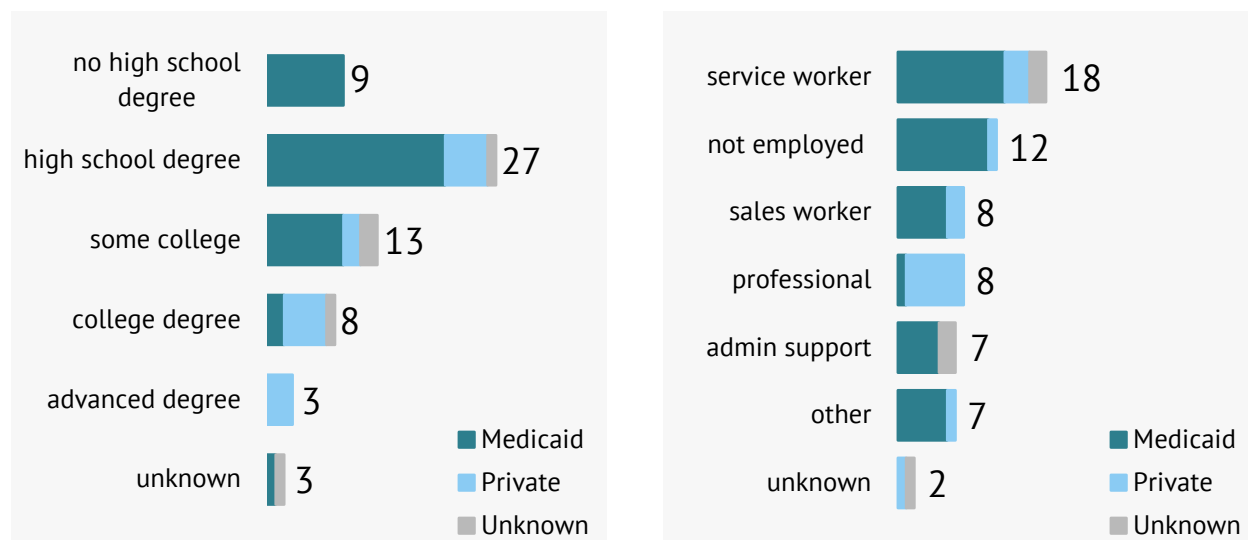
with advanced degrees and nearly two-thirds of those with an associate or a bachelor’s degree ($n = 5/8$) had private health insurance. By contrast, all of those who had not completed high school and a large majority of those with a high school degree ($n = 21, 78\%$) were covered by Medicaid insurance.

Regarding occupation, the CT MMR evaluators used the Equal Employment Opportunity (EEO) categories to assign job classifications based on occupations listed on decedents’ death certificates (see [Appendix C](#) for details). Among those whose deaths were pregnancy-associated, the most common job category was that of a service worker ($n = 18, 29.0\%$); this was followed by sales worker ($n = 8, 12.9\%$), professional ($n = 8, 12.9\%$), administrative support worker ($n = 7, 11.3\%$), and other job categories ($n = 7, 11.3\%$). Nearly one-fifth of the cohort included those who were not employed outside of home ($n = 12, 19.4\%$), and employment information was unavailable for two persons. Figure B-6 cross-lists job categories and health insurance to provide further insight into the role of social class in pregnancy-associated mortality in Connecticut. All but one of those who worked as professionals had private insurance. In contrast, at least seven in ten of those who occupied other job categories and over nine in ten of those who were not employed outside of home had Medicaid for insurance.

FIGURE B-6

Intersections among education, occupation, and health insurance

Among pregnancy-associated deaths, most of those with a college degree or an advanced degree had private (■) health insurance, whereas all of those without a high school degree and most of those with a high school degree had Medicaid (■) for insurance. Similarly, most professionals had private insurance, whereas most of those in other job categories had Medicaid for insurance.



Note: The “college degree” category in the breakdown above includes those with an associate degree.

Receiving assistance for Women, Infants, and Children (WIC) during pregnancy or postpartum could provide another indicator of social class, however data were only available for a little over half ($n = 32, 51.5\%$) of the

cases under review, making it difficult to ensure an accurate picture. This points to the need for the CT MMR Program to access more complete data for pregnancy-associated deaths in which WIC benefits were accessed.

Leading Causes of Death

The cause of death listed on a death certificate refers to the underlying disease process or injury that initiated the lethal sequence of events. To facilitate analyses of pregnancy-associated deaths, CT MMRC co-chairs grouped causes of pregnancy-associated deaths^v in Connecticut based on a classification scheme originally proposed by the *Building U.S. Capacity to Review and Prevent Maternal Deaths* report from nine MMRCs³ and recently updated within MMRIA. The distribution of deaths across these categories is presented in Table B-2.

TABLE B-3

Mental health conditions were leading causes of death

Substance use disorder accounted for the greatest number of all pregnancy-associated deaths, and other mental health conditions accounted for the greatest number of pregnancy-related deaths.

Leading causes of death	Pregnancy-associated deaths	Pregnancy-related deaths	Not pregnancy-related deaths
	count	count	count
Total mental health conditions			
Substance use disorder	16	4	11
Other mental health conditions	6	6	0
Unknown*	1	1	0
Total medical disorders			
Cardiovascular conditions	8	4	4
Cerebral vascular accident	3	1	2
Embolism	3	1	2
Hemorrhage	2	2	0
Infection	3	2	1
Malignancy	3	0	3
Other medical disorders**	5	3	1
Total injury			
Accidental overdose	3	1	1
Unintentional injury	5	0	4
Homicide	4	0	4
Grand total	62	25	33

Note: Pregnancy-associated deaths for which pregnancy-relatedness could not be determined by CT MMRC (n = 4) were excluded from the breakdown by pregnancy-relatedness. *Cause of death was categorized as "unknown" for one death to which substance use disorder and an underlying mental health condition contributed; the manner of death could not be determined by OCME. Although this death is listed under the category of mental health conditions, it is not included in their count. ** "Other medical disorders" category includes amniotic fluid embolism, cardiomyopathy, liver and gastrointestinal conditions, metabolic/endocrine conditions, and pulmonary conditions.

Substance use disorder accounted for the greatest number of all pregnancy-associated deaths ($n = 22$, 35.4%) in Connecticut between 2015 and 2019. Mental health conditions including substance use disorder were leading causes of pregnancy-related deaths ($n = 10$, 40.0%). The fact that four in ten pregnancy-related deaths may be attributed to mental health conditions echoes the Surgeon General’s Call to Action⁸ and Healthy People 2030⁶ goals, both of which highlight the importance of attending to mental health, and also substance use, throughout pregnancy and postpartum.

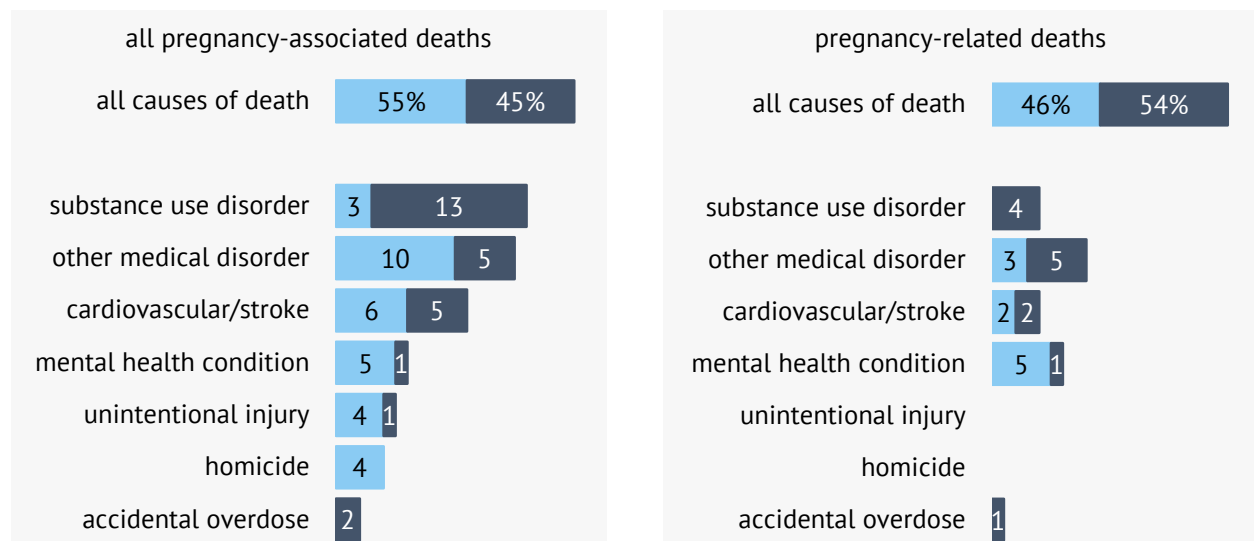
All medical diseases together accounted for roughly four in ten of all pregnancy-associated deaths ($n = 27$, 43.4%) and about half of pregnancy-related deaths ($n = 13$, 52.0%). The category of cardiovascular conditions was the largest medical disease category, accounting for eight out of 62 pregnancy-associated deaths; half of those ($n = 4/8$) were determined by CT MMRC to be pregnancy-related.

Injuries led to about one-fifth of all pregnancy-associated deaths ($n = 12$, 19.4%), only one of which was pregnancy-related. Among pregnancy-associated deaths, there were eight unintentional injuries, including three accidental overdoses for which there was no evidence of an underlying substance use disorder (medical records could not be accessed in one of these cases and were sparse in two other cases). One of the accidental overdoses was determined to be pregnancy-related. Lastly, there were four homicides, none of which were determined to be pregnancy-related.

FIGURE B-7

Cause of death categories differed by race/ethnicity

All deaths due to substance use disorder and two out of three accidental overdoses (one not shown) occurred to White (■) persons. All homicides, most unintentional injuries ($n = 3/4$), and most deaths due to mental health conditions other than substance use disorder ($n = 5/6$) occurred to Black and Latinx (■) persons.



Note: Because of small numbers, Black and Latinx persons were grouped together.

There are striking differences by race/ethnicity in the distribution of cause of death categories (Figure B-7). Among all pregnancy-associated deaths, White persons accounted for 13 out of 16 deaths due to substance use disorder and two out of three accidental overdoses (one overdose occurred to a person of another ethnic background and is not shown on Figure B-7). By contrast, Black and Latinx persons accounted for all homicides, four out of five unintentional injuries other than accidental overdose, and five out of six deaths due to a mental health condition other than substance use disorder. Black and Latinx persons were also overrepresented among deaths due to medical disorders other than cardiovascular disorders/stroke.

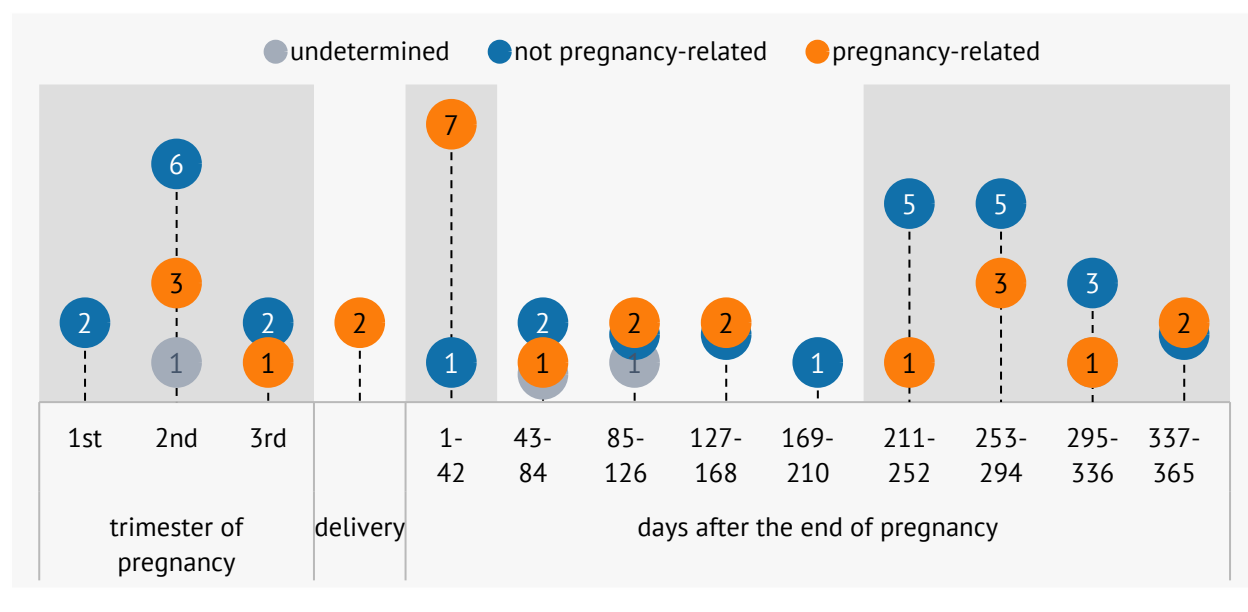
Timing of Death

Between 2015 and 2019, about a quarter of all pregnancy-associated deaths ($n = 17, 27.3\%$) in Connecticut, and a similar proportion of deaths that were pregnancy-related ($n = 6/25$), occurred during pregnancy or on the day of delivery (Figure B-8). About six in ten of those that were pregnancy-associated ($n = 37, 59.6\%$) and close to half of those that were pregnancy-related ($n = 12, 48.0\%$)—occurred in the late postpartum period, between 43 and 365 days after the end of pregnancy. In fact, more than one-third of pregnancy-associated deaths ($n = 23, 37.1\%$) and over a quarter of deaths that were pregnancy-related ($n = 7/25$) occurred more than seven months (211 days) after the end of pregnancy.

It is worth restating the fact that pregnancy-related deaths occurred not only during pregnancy and the six-week period following its conclusion, but throughout the year-long period after the delivery, as Figure B-8 shows. Not only is this consistent with calls to extend care through the 12-week period referred to as “the fourth trimester,”²⁴ but it also draws attention to the need to extend comprehensive care to a full year and to expand Medicaid coverage to include care during this extended period.³³

FIGURE B-8

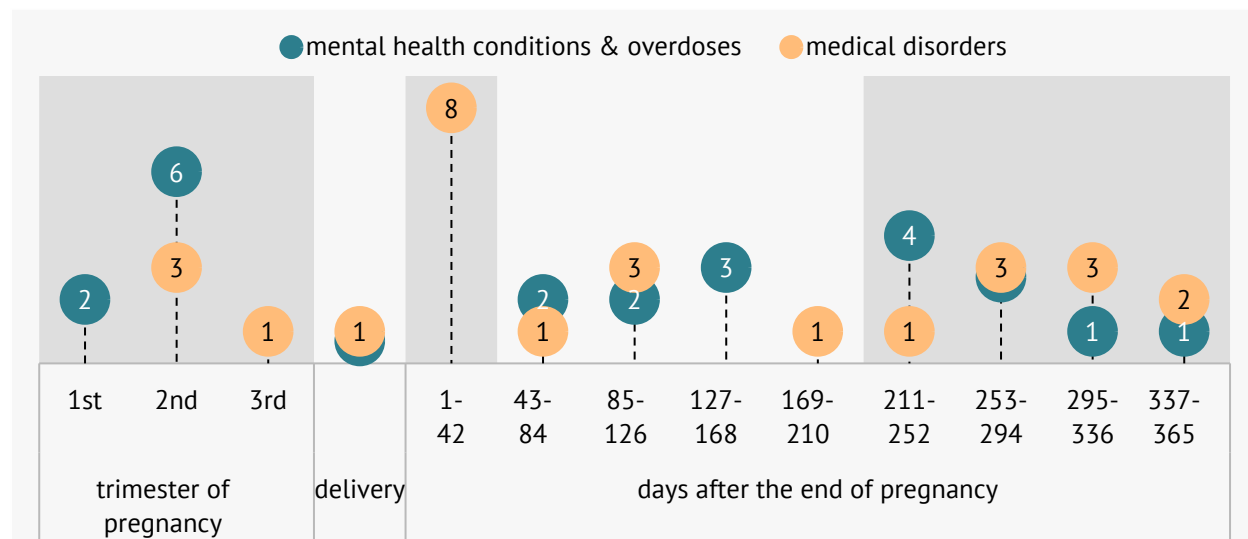
Timing of death by pregnancy-relatedness



Lastly, it is worth highlighting a difference between pregnancy-related and not pregnancy-related deaths concerning the six-week postpartum period: of ten deaths that occurred during delivery or within 42 days (six weeks) after the end of pregnancy, nine were pregnancy-related and one was not-pregnancy related (Figure B-8). It is also interesting that nine out of ten deaths that occurred during the same timeframe were due to medical diseases; only one was due to a mental health condition (Figure B-9).

FIGURE B-9

Timing of death by cause of death



Note: Deaths due to homicide, unintentional injury other than accidental overdose, and unknown/undetermined cause are not shown.

Location of Death

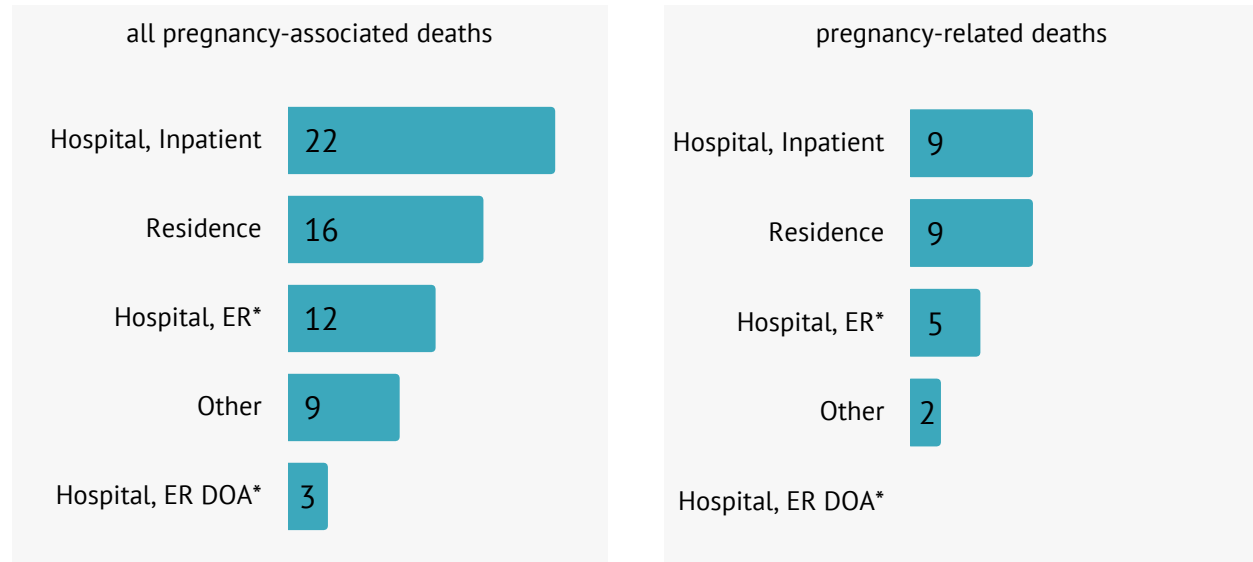
Over half of pregnancy-associated deaths in Connecticut occurred in hospital settings ($n = 37, 59.5\%$): roughly one-third during hospital inpatient care ($n = 22, 35.4\%$) and close to one-fifth in the emergency room ($n = 12, 19.3\%$). Three were dead on arrival to the emergency room.

About four in ten pregnancy-associated deaths happened outside of hospital settings: about a quarter in decedents' residences ($n = 16, 25.8\%$), and over one-tenth in other places ($n = 9/62$). The distribution of locations was similar for the subset of deaths that were determined by CT MMRC to be pregnancy-related (Figure B-10): over 4 in 10 died outside of hospital settings and over one-third died during hospital inpatient care. While many, if not most, prevention efforts focus on medical procedures and hospital protocols, these results point to the importance of prevention and care beyond the hospital setting.

FIGURE B-10

About 4 in 10 deaths occurred outside of hospital settings

Inpatient hospital settings were the most frequent place of death for all pregnancy-associated deaths, as well as for those deaths that were pregnancy-related. Nonetheless, about 40% of all pregnancy-associated deaths and 44% of pregnancy-related deaths happened outside of hospital settings.



*ER = emergency room; DOA = dead on arrival.

Manner of Death

The manner of death represents the circumstances for how the death occurred. Based on federal guidelines, these circumstances may be classified as either “natural” or “unnatural.” The “natural” category includes deaths due exclusively to medical disease processes; no injury or intoxication can contribute. Primary care providers or hospital physicians can issue this type of death certificate. The “unnatural” category is further divided into five subcategories: 1) accident, which includes deaths due to inadvertent injuries or intoxication; 2) suicide, which includes deaths from injury with intent to end one’s own life; 3) homicide, which includes deaths at the hand of another; 4) undetermined, which includes deaths for which insufficient information is available to determine if an injury contributes to the death and/or how an injury occurred; and 5) therapeutic complication, which includes deaths hastened by procedures where there was a complication. By state statute, all “unnatural” deaths must be reported to and investigated by the Office of the Chief Medical Examiner (OCME). The OCME uses all available information from the family, the police, the autopsy, and toxicology to determine the manner of death and to issue the death certificate.

The manner of death was classified as natural for nearly half of all pregnancy-associated deaths ($n = 30$, 48.4%) and over half of pregnancy-related deaths ($n = 14$, 56.0%) in Connecticut between 2015-2019. The manner of death was determined accidental in about one-third of all pregnancy-associated deaths ($n = 21$, 33.9%), only

four of which were pregnancy-related. There were six suicides among pregnancy-associated deaths, and all were determined by CT MMRC to be pregnancy-related. All four pregnancy-associated homicides were determined to be not pregnancy-related. The manner of death could not be determined by OCME in one case.

SUICIDE

There were six deaths between 2015 and 2019 in which suicide was listed as manner of death by the CT OCME. All six were determined by CT MMRC to be pregnancy-related; and all six were determined to be preventable. Two suicides occurred during pregnancy, and four took place in postpartum/late postpartum (5.5 months, 9 months, 10.5 months, 11 months). Five out of six decedents were persons of color: three were Black, two Latinx, and one White. Levels of education varied widely, from no high school degree to an advanced degree. Three had Medicaid for health insurance, and three had private insurance. They were 27 years old on average.

A qualitative analysis (see methods in [Appendix C](#)) of case narratives revealed commonalities among those who died by suicide. First, five out of six case narratives mention a significant history and/or current state of depression. The sixth case narrative refers to a history and current state of anxiety. Anxiety was present along with depression in three cases. One had additional comorbid psychiatric diagnoses and a history of suicidal gestures. In other words, mental health concerns prior to and during pregnancy and postpartum were precursors to death in all six cases.

Second, inadequate intervention and lack of mental health and substance use care were common across cases. Mental health conditions were determined by CT MMRC to have contributed to all deaths by suicide (all six of these cases are also included in the section on mental health as a contributing factor), yet only one was receiving ongoing mental health care shortly before or at the time of death. Substance use disorder was listed by CT MMRC as contributing to death in two cases (these two cases are also included in the section on substance use as a contributing factor).

Three out of six case narratives included some attempt to intervene after labor; however, interventions were limited and/or unsuccessful. Interventions included a brief meeting with a social worker ($n = 3$), written information on the “baby blues” ($n = 1$), referral for a Visiting Nurse ($n = 1$; declined), and referral ($n = 1$) or attempted referral ($n = 1$) to a psychiatrist or therapist. Co-occurring (potentially exacerbating) problems were noted, but again, no interventions were made. For example, one case narrative mentioned a positive screening for intimate partner violence, but no intervention followed the screening. These findings call for routine, comprehensive, and effective mental-health screening, intervention, and treatment during and following pregnancy.

HOMICIDE

There were four cases of pregnancy-associated deaths by homicide in Connecticut between 2015 and 2019. One of these was an accidental shooting in which the decedent was not the intended victim. The remaining homicides ($n = 3/4$) were committed by an intimate partner and were, therefore, cases of intimate partner violence

(IPV). One occurred during pregnancy, and two occurred in the postpartum period (2 months and 6 months). CT MMRC determined all four cases to be not pregnancy-related. Additionally, CT MMRC determined two homicides to be preventable, and two not preventable. Three of those who died by homicide were Black and one was Latinx. Level of education was evenly divided between high school completion and the completion of some college courses. Three out of four had Medicaid for health insurance. They were 30 years old on average.

A qualitative analysis of the three case narratives revealed failure to identify and intervene in IPV. There were no warning signs and multiple negative screenings for IPV in two cases of homicide. There were, however, multiple “red flags” in one homicide, including several visits to the emergency department for “accidents” consistent with IPV (eg, trauma to abdomen, fear of fetal damage, suspicious descriptions of injury causes). Several screenings for IPV were negative in this case and no referrals were made for counseling, support, or protection.

Exploring referrals for IPV across all 62 cases of maternal mortality (pregnancy-related and not pregnancy-related) in Connecticut between 2015 and 2019 revealed only one case in which a referral was made for IPV. No follow-up or further action was noted in the case narrative. In one other case it was noted that the pregnant patient and male partner had been court ordered to go to counseling. These findings suggest the need for more effective IPV screening, protocols for noticing and responding to suspected IPV, and established procedures for IPV intervention.

Preventability of Death

Based on a review of medical records and other available evidence, CT MMRC assesses preventability of each death. Deciding upon preventability is difficult, and there is often considerable uncertainty around final determinations. As one Committee member pointed out, going far enough upstream along a chain of hypothetical events would result in a determination of preventability for all deaths. Nonetheless, keeping in mind the ultimate goal of maternal mortality review, which is to develop actionable recommendations for prevention, the Committee decided that at least some deaths that occurred in 2015-2019 were not preventable. More specifically, roughly one-quarter of pregnancy-associated deaths were determined to be not preventable ($n = 17$, 27.4%) and almost three-quarters were determined to be preventable ($n = 45$, 72.6%), as Figure B-11 shows. Preventability was higher among the subset of pregnancy-associated deaths that were pregnancy-related than among the subset of those that were not pregnancy-related. Namely, close to nine in ten pregnancy-related deaths ($n = 22$, 88.0%) and around six in ten not pregnancy-related deaths ($n = 20$, 60.6%) were determined by CT MMRC to be preventable.

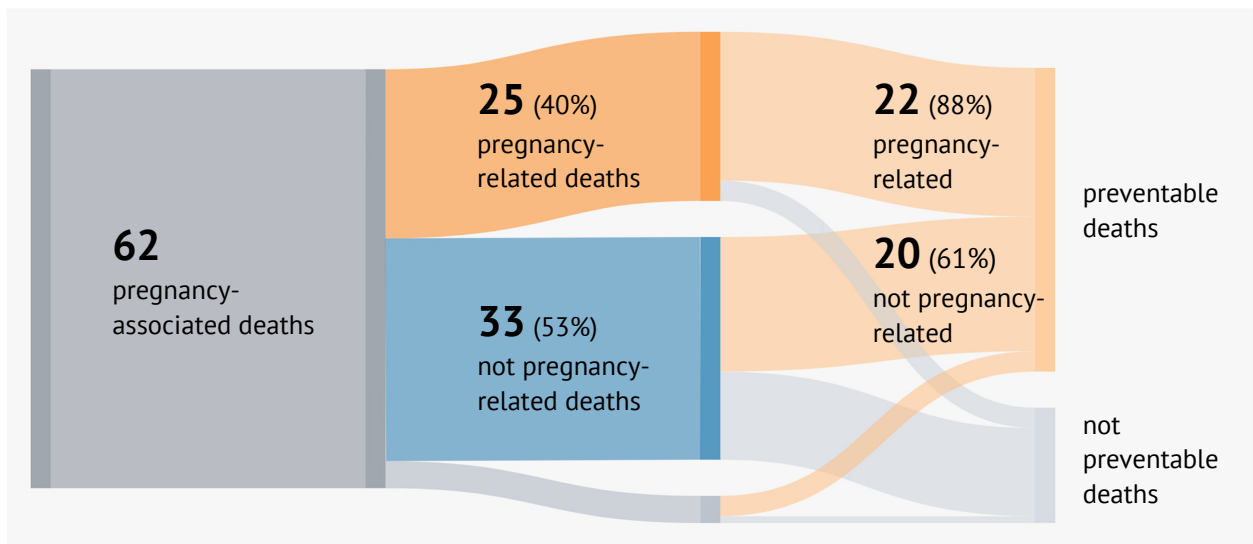
It is important to point out that out of 25 pregnancy-related deaths, only three, all due to medical diseases, were determined to be not preventable. In contrast, CT MMRC determined all deaths due to mental health conditions, substance use, and cardiovascular conditions, as well as deaths due to cerebral vascular accidents, embolism, metabolic/endocrine conditions, and pulmonary conditions to be preventable.

Another noteworthy point concerns a comparison with national data. CT MMRC's estimate of preventability (88%) exceeded CDC's estimate based on data from nine states (Colorado, Delaware, Georgia, Hawaii, Illinois, North Carolina, Ohio, South Carolina, and Utah). Close to two-thirds (63.2%) of pregnancy-related deaths that occurred between 2012 and 2017 within the nine states that contributed that to CDC's review were determined by MMRCs in those states to be preventable.³ As MMRCs across the country become more consistent in applying a public health lens, under CDC's leadership, it will be interesting to see whether Connecticut's estimate of preventability becomes more closely aligned with national estimates.

FIGURE B-11

A large majority of pregnancy-related deaths were preventable

Of 25 pregnancy-related deaths, 22 (88%) were determined by CT MMRC to be preventable.



Contributing Factors

In Connecticut, the review of pregnancy-associated deaths starts with decisions about pregnancy-relatedness and preventability. For deaths that are determined to be pregnancy-related and preventable, CT MMRC identifies factors that contributed to the death and that, if modified, might have prevented it. Information about contributing factors serves as a starting point for the development of actionable recommendations to prevent future deaths.

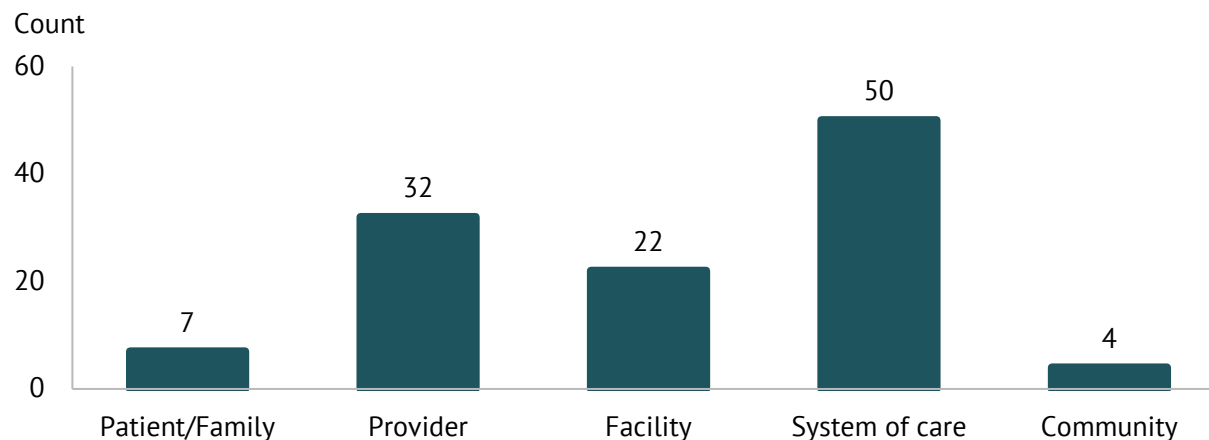
Contributing Factor Class and Level

In accordance with CDC's guidelines, each contributing factor is assigned a level and a class.²⁸ The level refers to the placement within a social system, and it includes the categories listed on CDC's *Committee Decisions Form*: 1) patient/family, 2) provider, 3) facility, 4) system of care,^{vi} and 5) community.²⁸ The class refers to a thematic grouping of contributing factors based on subject matters such as financial resources, chronic disease, unstable housing, continuity of care, and quality of care, to name a few. For the 22 preventable pregnancy-related deaths that occurred in 2015-2019, CT MMRC identified 115 contributing factor classes. Notably, over three-quarters of contributing factor classes ($n = 89, 77\%$) were identified for the deaths that occurred in 2018-2019, and fewer than one-quarter ($n = 26, 23\%$) were identified for the deaths that occurred in 2015-2017. In other words, there was a marked increase in the number of contributing factor classes per case after 2017. This increase reflects a change over time in CT MMRC's approach to death review, largely in response to CDC's feedback and in an effort to increase the quality of actionable recommendations, which are based on the contributing factor classes. Figure C-1 shows the distribution of contributing factor classes across levels within a social system for deaths that occurred between 2015 and 2019.

FIGURE C-1

Most contributing factors were located at the system of care level

Distribution of contributing factors ($n = 115$) for preventable pregnancy-related deaths, 2015-2019



Contributing Factors

Most contributing factor classes were located at the level of system of care (43.4%); this was followed by provider (27.8%) and facility (19.1%). Relatively few factors were identified at the levels of patient/family (6.1%) and community (3.4%). Across levels, the most commonly occurring classes of contributing factors included clinical skill/quality of care ($n = 12$), knowledge ($n = 12$), continuity of care/care coordination ($n = 11$), communication ($n = 11$), and referral ($n = 10$). Table C-1 contains a listing of contributing factors classes, with illustrative examples, grouped by the level, for preventable pregnancy-related deaths that occurred between 2015 and 2019.

TABLE C-1

Contributing factor classes

Summary of contributing factor classes for preventable pregnancy-related deaths, 2015-2019. Listed are only those contributing factor classes with a frequency of two or above.

Contributing Factor Class	Count	Example
Patient/Family Level		
Adherence	2	Patient did not adhere to the treatment plan and/or did not keep follow-up appointments.
Substance Use Disorder	2	Patient tested positive for marijuana in emergency department.
Provider Level		
Clinical Skill/ Quality of Care	10	There was no ECHO, EKG, or work-up for severe hypertension in the prenatal period. Anti-hypertensive medication was not administered.
Knowledge	7	Prenatal care providers need additional knowledge on domestic violence screenings and available resources.
Assessment	4	Need for education on available evidence-based screening tools for domestic violence, perinatal depression, and substance abuse.
Mental Health Conditions	3	Prenatal care provider did not coordinate care with mental health providers.
Continuity of Care/ Care Coordination	3	Prenatal care provider did not make referral to a home visiting program.
Facility Level		
Referral	5	Patient repeatedly asked for substance use treatment help and it was not provided. Lacked referrals for mental health (anxiety). Lacked referrals for breastfeeding support.
Continuity of Care/ Care Coordination	4	Lack of continuity of care and care co-ordination. Lack of support for persons with mental health disorder who are emergency department or inpatient hospital patients.

Contributing Factor Class	Count	Example
Policies/Procedures	3	Policy for administering baby ASA and antihypertension medications. Patient and provider were not notified of the critical lab result by emergency department.
Communication	3	Interpreter was not always offered or provided. Lack of communication between emergency department and obstetrics provider. Patients don't always know name of obstetrics provider and obstetrician doesn't know of emergency department visits.
Knowledge	2	Need for documentation of discharge plan and education to patient about importance of mobility following cesarean section. Patient records demonstrate a history of trauma, but providers were not aware.
Assessment	2	No intimate partner violence or depression screenings.
Systems of Care		
Communication	7	Lack of communication between Department of Children and Families and providers, esp. hospitals. Obstetrics providers unaware of how to refer patients to HUSKY Intensive Case Management and what services are available.
Access/Financial	6	Access to same day long-acting reversible contraceptives. Lack of health insurance and no referral to Medicaid at any point during pregnancy. Lack of available beds for pregnancy/postpartum persons with mental health conditions.
Referral	4	Mental health symptoms and no referral. Providers do not know what services and referrals resources are available for patients.
Continuity of Care/ Care Coordination	4	Cross-communication and coordination among all providers seeing the patient. Lack of a single point of entry to programs for pregnant or parenting persons with known substance use.
Policies/Procedures	3	Had unstable housing and substance use; not eligible for 24/7 mother-baby housing without the child.
Knowledge	3	Interdisciplinary provider training needed on wrap-around services.
Trauma	3	Need supports for persons who have children removed by Department of Children and Families.
Legal	3	Parental termination of rights.
Discrimination	2	Patient was of color and obese.
Mental Health Conditions	2	Coverage for mental health treatment.
Unstable Housing	2	Patient was homeless for four months.
Social Support/Isolation	2	Patient lacked social support.

Contributing Factor Class	Count	Example
Outreach	2	No follow-up with missed appointments by providers.
Community Level		
Social Support/Isolation	4	Lack of social supports and community level. Patient lost social support. Lack of community collaborative.

In considering the findings presented in Table C-1, it is important to keep in mind that CT MMRC did not systematically record substance use disorder, mental health conditions, and discrimination under the rubric of contributing factor classes until 2021—that is, midway through the review of deaths that occurred in 2018. Put another way, the frequency of these contributing factor classes—substance use disorder ($n = 3$), mental health conditions ($n = 6$), and discrimination ($n = 3$) listed in Table C-1—underrepresents their actual contribution to the deaths under analysis. A more complete picture of the role of mental health and discrimination comes from CT MMRC’s review of circumstances surrounding death. More specifically, CT MMRC weighs the contribution of substance use disorder, mental health conditions, discrimination, and obesity to each pregnancy-associated deaths regardless of its relatedness to pregnancy or preventability. The following sections contain a more detailed description of these factors based on analyses of MMRIA data (ie, decedents’ demographic characteristics and description death), and based on qualitative analyses of case narratives for subsets of deaths to which substance use disorder and other mental health conditions contributed (see [Appendix C](#) for details).

Substance Use Disorder

The CT MMRC determined that substance use disorder contributed to 20 pregnancy-associated deaths between 2015 and 2019. Of these, six were determined to be pregnancy-related and 13 not pregnancy-related; pregnancy-relatedness could not be determined in one case. Between 2015 and 2017, CT MMRC had not yet begun using the standardized decision-making criteria for mental health-related deaths to be considered pregnancy related; these criteria are known in Connecticut as the Utah criteria. By retrospectively applying the Utah Criteria to deaths that occurred during this period, evaluators determined that four additional deaths to which substance use disorder contributed (and one to which substance use disorder *probably* contributed) would have likely been considered pregnancy-related by CT MMRC if these criteria been applied to deaths that occurred in 2015- 2017 (see [Appendix C](#) for additional detail).

Substance use disorder contributed to six, and *probably* contributed to an additional two, out of 25 pregnancy-related deaths. Additionally, it contributed to 13, and *probably* contributed to an additional three, out of 33 not pregnancy-related deaths. Deaths to which substance use disorder *probably* contributed are not included in this analysis because of paucity of relevant data.

All deaths to which substance use disorder contributed were determined by CT MMRC to be preventable. Over half of deaths ($n = 13/20$) were accidental overdoses on the heels of a substance use disorder; other causes of death included accidental overdose with insufficient information to determine whether the decedent had a

substance use disorder ($n = 2$);^{vii} complications associated with chronic substance use ($n = 3$); mental health conditions other than substance use disorder ($n = 1$); and unintentional injury ($n = 1$). Eight deaths occurred during pregnancy and 12 occurred between 43 and 365 days after the end of pregnancy. Most deaths occurred in decedents' residences ($n = 7$); this was followed by emergency rooms ($n = 4$), hospital inpatient settings ($n = 4$), and other places ($n = 4$); one person was dead on arrival to an emergency room.

Regarding decedents' demographic characteristics, they were on average 29 years old, with a range between 18 and 39 years. Fifteen out of 20 were White, four were Black, and one was Latinx. Half ($n = 10/20$) had a high school education and nearly half ($n = 9/20$) had some college, an associate's, or a bachelor's degree. Fifteen out of 20 had Medicaid for health insurance; two had private insurance; and insurance information was unavailable for three decedents. The most common job category was that of a service worker ($n = 6$); this was followed by administrative support worker ($n = 5$); sales worker ($n = 2$); and job categories such as technician or laborer ($n = 3$). Four persons were not employed outside of home.

In two of the 20 cases in which substance use disorder contributed to the death, pregnancy was determined via autopsy. No other records were available and there was no clear indication that the persons knew they were pregnant at the time of their deaths. In total, the Committee determined that the substance use disorder was clearly a contributing factor in 18 cases in which pregnancy was revealed prior to death.

A qualitative analysis of case narratives revealed a common ($n = 16/18$) history of struggling with substance addiction. In one additional case, a history of substance addiction can be assumed as pregnancy was diagnosed during an emergency department visit due to substance use. Substance addiction was also indicated by use of suboxone and/or methadone in 11 cases. In addition, half ($n = 9/18$) reported to their medical provider that they had been, or were currently in, a substance addiction treatment program. Two of these reported attending multiple drug rehabilitation programs in the past. One additional person reported attending Alcoholics Anonymous. At least sixteen of the eighteen people in this group suffered from polysubstance use or misuse. Recorded substances included cocaine ($n = 8$), cannabis ($n = 7$), PCP ($n = 2$), crystal methamphetamine ($n = 1$); alcohol ($n = 5$); benzodiazepines ($n = 7$); and oxycodone, fentanyl, heroin, and other opioids ($n = 16$).

Over three quarters ($n = 14/18$) had one or more mental health diagnoses in addition to substance use disorder. What is more, one person was self-cutting which would indicate an undiagnosed mental health problem. Mental health diagnoses included depression ($n = 6$), anxiety ($n = 7$), schizophrenia and schizoaffective disorder ($n = 2$), bipolar disorder ($n = 2$), post-traumatic stress disorder ($n = 2$), adjustment disorder ($n = 1$), and attention deficit disorder ($n = 3$). CT MMRC determined that mental health conditions other than substance use disorder contributed to half of the deaths ($n = 9/18$) to which substance use disorder also contributed. One case (also included in the section on suicide) ultimately resulted in suicide.

Case narratives revealed that most of those for whom substance use disorder contributed to death lived difficult lives. This included homelessness ($n = 3$), incarceration ($n = 3$), adverse childhood experiences ($n = 3$), sexual

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assault ($n = 1$), foster care ($n = 1$), intimate partner violence ($n = 6$), involvement with the Department of Children and Families (DCF; $n = 7$), hospitalization for psychiatric disorders ($n = 3$), unwanted pregnancy ($n = 1$) and teen pregnancy ($n = 2$). Most ($n = 15/18$) lived on low income as reflected by their reliance on Medicaid for insurance. Multiple factors converged for many, creating complex and challenging life circumstances.

Those with the substance use disorder varied in the ways they managed their use during pregnancy. Two died from a drug overdose within 1-3 days after being released from the hospital where they had been notified of their pregnancy. Management of substance use in the remaining cases ranged from abstinence with commitment to recovery, to limited use, to continuing use.

Reports of drug use during pregnancy were not always available and determining substance use during pregnancy is difficult due to underreporting and sporadic use. For example, there was no clear documentation of substance management in three cases and in two cases patients reported abstinence yet had positive drug tests. According to the case narratives in which information on substance use during pregnancy was available ($n = 11$), three people stopped or tapered medical treatment for substance use (ie., suboxone or methadone) due to pregnancy. One who stopped methadone died of a fentanyl overdose during pregnancy. Another who weaned off suboxone died during pregnancy due to complications of chronic substance use. Yet another whose methadone was reduced survived pregnancy but died of a heroin and fentanyl overdose three months postpartum. One person who reported having been “clean for 120 days” at her first trimester appointment died of an overdose during the second trimester. Another used heroin, cocaine, and methadone throughout pregnancy, without documented attempts to taper or abstain. Three pregnant persons appeared to primarily limit their use to marijuana throughout their pregnancies. One of these also used anti-anxiety medications. At least three successfully reached abstinence from substance use during pregnancy as evidenced by negative toxicology reports.

Review of case narratives revealed significant “gaps” in how referrals were made and “missed opportunities” for substance use and mental health treatment interventions. Two case narratives mention patients currently being in substance use treatment. There was no opportunity for referral in one additional case in which the patient died during an initial emergency room visit. Out of the remaining cases, only five mention a referral for detox or substance use treatment. An additional case narrative mentions a patient receiving contact information for a treatment center. In addition, those referrals that were made lacked attention to continuity of care. For example, one person who was homeless was informed of their pregnancy while hospitalized for polysubstance use and psychosis. Appointments were made at a community health resource center and with a psychiatrist for the following week; however, the patient died of a drug overdose on the day of discharge. The patient was released from the hospital, given instructions and resources along with a bus ticket to reach a place to stay. In another case, as the result of a postpartum ED visit, an appointment was made for a patient to start substance addiction treatment ten days after discharge. There was no follow-up and the patient died of an overdose several months later.

In yet another case, a person repeatedly requested detox in the emergency room without success. This person visited the emergency room at eight months postpartum requesting detox, and, according to the case narrative, “was to check into rehab the following day.” They were sent home without seeing a social worker or psychiatrist. Several days later they visited the emergency room again requesting detox, and, according to the case narrative, were “given a sandwich, soda and prescription for pain [medication] and discharged to home. [They were] not seen by social work or psychiatry.” This person again requested detox in an emergency room, during the late postpartum period, and was seen by a social worker. According to the case narrative, “The crisis worker said that [they] would be unable to get [them] into a rehab facility because of the holiday, the facilities were not doing intakes on [a holiday], but would see what was available. [They were] given a number to call the next day to be admitted to a rehab bed” and were discharged. A couple of months later, the person was taken to the emergency room for a drug overdose. The case narrative notes that they were observed until stable and were then “instructed to stop using [...] (per the emergency room physician note ‘I counseled [the] patient on the importance of avoiding drugs of abuse [...]. Patient communicated to me by stating [they] understand the risk. Patient reports [they] otherwise feel well.’). [They were] discharged to home. [There were] not seen by social work or psychiatry.”

In two other cases referrals and/or patient plans for inpatient or outpatient substance use disorder treatment did not come to fruition. An exception was a person who was seen by a social worker several times, along with a DCF worker, before being successfully discharged to a residential treatment facility on postpartum day four. In two-thirds of all cases reviewed ($n = 12/18$), no referral was made for either mental health or substance use disorder treatment or support.

The most common classes of contributing factors for deaths to which substance use disorder contributed include clinical skill and quality of care, knowledge, communication, continuity of care and care coordination, referral, assessment and policies and procedures. When these classes of contributing factors are clustered, a pattern emerges pointing to the urgent need for routine screening and intervention that leads to comprehensive, coordinated care throughout pregnancy and postpartum for those suffering from the substance use disorder.

Mental Health Conditions

The CT MMRC determined mental health conditions other than substance use disorder contributed to 16 deaths in the period between 2015 and 2019. The Committee categorized ten of these as pregnancy-related and six as not pregnancy-related. Additionally, they noted that mental health conditions *probably* contributed to death in seven cases, one of which was pregnancy-related, three not pregnancy-related, and three undetermined. The deaths to which mental health conditions probably contributed were not included in this analysis because of paucity of relevant information.

All 16 deaths to which mental health conditions contributed were determined by CT MMRC to be preventable. Causes of death included mental health conditions ($n = 6$); accidental overdose in the context of a substance use disorder ($n = 6$); accidental overdose without sufficient information to confirm the presence of a substance use

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disorder ($n = 1$); unintentional injury ($n = 1$); unknown cause of death ($n = 1$); and death due to a medical disorder ($n = 1$). Five persons died during pregnancy and the remaining eleven during postpartum. Close to half ($n = 7/16$) died in their residences; other locations of death included emergency rooms ($n = 3$), hospital inpatient settings ($n = 2$), and other location in one instance. One person was dead on arrival to the emergency room ($n = 1$). Manner of death included accidental for half of deaths ($n = 8/16$); there were also six suicides, one natural death, and one death in which the manner was undetermined.

Regarding decedents' demographic characteristics, the average age was 26 years old, with a range between 16 and 36 years. Close to half ($n = 7/16$) were White; this was followed by Black ($n = 5$) and Latinx ($n = 4$). Almost two thirds ($n = 11/16$) had Medicaid for health insurance; four had private insurance and insurance was unknown for one person. Close to half ($n = 7/16$) had some college and two had at least an associate degree; five had a high school degree and two did not have a high school degree.

The most common psychiatric disorders among the 16 cases in which mental health conditions contributed to death included anxiety ($n = 8$) and depression ($n = 6$), followed by bipolar disorder ($n = 3$), schizophrenia/schizoaffective disorder ($n = 2$), attention deficit disorder ($n = 2$), and post-traumatic stress disorder ($n = 1$). Two or more co-occurring mental health conditions were listed in six cases. Thirteen used substances at some point in their lives, and there was co-occurring substance use disorder in 11 of the 16 cases. What is more, CT MMRC determined that substance use disorder contributed to the death in nine cases and *probably* contributed to the death in three of these cases. Intimate partner or family violence was reported in three cases; there was evidence of adverse childhood experiences for five persons, at least one of whom was subjected to sexual abuse.

Qualitative analysis of these cases revealed gaps in attention to, and care for, mental health conditions during pregnancy and postpartum. While there were several referrals made for mental health care across case narratives, there did not appear to be a system in place for routine screening, immediate and adequate support, or long-term intensive care for mental health disorders. Examples of missed opportunities for effective intervention include a case in which depression pre-existed pregnancy, was screened as negative by a social worker after labor, and eventually detected in a 2-month postpartum visit. At that time, the patient “complained about insomnia, intermittent crying and feeling overwhelmed” and was screened positive for depression. The person was instructed to return in two weeks for a mood check. During this follow-up visit, they reported feeling better and a 20-minute counseling session ended with instructions to “call with further issues and schedule a routine GYN visit in 1 year.” In another case, the person went to the emergency room at 15-weeks' gestation with symptoms of anxiety but did not see a social worker or psychiatrist. They again presented at 19-weeks' gestation to the emergency room with increased depressive symptoms and passive suicidal ideation. Social work and psychiatry were consulted during this visit, and it was determined that the patient did not meet criteria for inpatient treatment. According to the case narrative “[they were] set up with a follow-up appointment with [their] psychiatrist and arrangements were made for outpatient therapy. [They were] given the crisis hotline number in [their] discharge paperwork.” This person later denied depression when seen by social work on postpartum day

1 and 2 and was instructed “to call if [they] noted [their] depression was worsening or [they were] feeling overwhelmed.” An offer of Visiting Nurse Association (VNA) due to a history of depression was declined. Screening for intimate partner violence was not completed in this case during routine prenatal visits, but was revealed in an ED visit.

Another gap in mental health care occurred when pregnant persons stopped taking prescription medication to control symptoms of mental health disorders. Two case narratives report cessation of prescription medications for psychiatric diagnoses (bipolar disorder, depression, anxiety disorder, ADHD) due to pregnancy. In one case there is no documentation of mental health visits or referrals. In the other case there was a referral to social work due to bipolar disorder and history of substance use disorder, but there was no mention of support for cessation of psychotropic medications.

The most common contributing factor classes in relationship to deaths in which mental health contributed include clinical skill and quality of care, knowledge, communication, continuity of care and care coordination, referral, assessment, and policies and procedures. These contributing factor classes mirror those found in relation to substance use. Again, when these classes of contributing factors are clustered, a pattern emerges that points to urgent need for routine screening and intervention that leads to comprehensive, coordinated care throughout pregnancy and postpartum for those suffering from mental health disorders.

Co-Occurrence of Mental Health Conditions and Substance Use Disorder

Mental health conditions and substance use disorder often co-occur and require a health care approach that recognizes the relationship between these disorders, according to the Substance Abuse and Mental Health Services Administration (SAMSHA).³⁴ Out of 62 pregnancy-associated deaths in Connecticut between 2015-2019, both substance use disorder and mental health conditions contributed to nine deaths and *probably* contributed to three deaths. What is more, an overwhelming majority of those with mental health conditions as a contributor to the death used substances at some point in their lives ($n = 13/16$). Similarly, a majority of those with substance use disorder as a contributor to death ($n = 14/20$) had co-occurring mental health conditions. The frequency of co-occurrence of these contributing factors calls for careful assessment, appropriate intervention, and comprehensive treatment for co-occurring disorders.

Discrimination

Starting with deaths that occurred in 2018, CT MMRC’s review of circumstances surrounding death included discussion on whether discrimination—structural racism, interpersonal racism, or other discrimination—contributed to the death. In consultation with a representative from the University of Connecticut Health Disparities Institute—a member of the Committee—CT MMRC decided to list structural racism as a contributing factor class for all preventable pregnancy-related deaths of persons of color, without considering the particulars

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of a case. With interpersonal racism and discrimination, the Committee weighed the contribution of these factors to each pregnancy-associated death, regardless of pregnancy-relatedness and preventability, by considering actions described in case narratives and language found in medical records, as highlighted by the CT MMR abstractor.

CT MMRC determined that discrimination played a role in six out of 30 deaths in 2018-2019, three of which were pregnancy-related and three not pregnancy-related. Additionally, discrimination *probably* played a role in 11 deaths: seven pregnancy-related, two not pregnancy-related, and two with undetermined relatedness. In all, discrimination contributed or *probably* contributed to more than two-thirds ($n = 10/14$) of pregnancy-related deaths in 2018-2019, all but one of which ($n = 9/10$) were determined to be preventable. Additionally, discrimination contributed or *probably* contributed to about one-third ($n = 5/14$) of not pregnancy-related deaths in 2018-2019, most of which ($n = 4/5$) were determined to be preventable

Among pregnancy-associated deaths to which discrimination contributed, as determined by CT MMRC, the cause of death was accidental overdose in the context of a substance use disorder in three cases; medical disease in two cases; and mental health conditions in one case. The manner of death was ruled accidental in three cases, natural in two cases, and suicide in one case. Three persons died during pregnancy and three in postpartum. Locations of death included emergency room ($n = 3$), decedent's residence ($n = 2$), and other places ($n = 1$).

Regarding decedents' demographic background characteristics, five out of six were persons of color (three Black and two Latinx) and one was White. All six had Medicaid for insurance. Two had some college education, but none held a college degree. Three were not employed outside the home; one was a service worker, one an administrative support worker, and one a student.

In five cases, CT MMRC found evidence of discrimination based on decedents' actual or presumed substance addiction, although other factors—including decedents' race/ethnicity, socioeconomic status (as indicated by health insurance, education, and occupation), social history (housing instability or insecurity, incarceration, DCF involvement), appearance (obesity), and mental health conditions—were likely to have played a role, as well, in the discrimination. Evidence of discrimination included disrespectful language in medical records, undertreatment, inadequate discharge planning, or often, a combination thereof. For example, one person of color, whose life was riddled with difficulties, was not given pain medication despite the fact that multiple drug screens showed no evidence of the use of narcotics. What is more, they were discharged from an emergency room without being connected to medical or social resources. In CT MMR abstractor's words: "language dismissing concerns, lack of respect, and assumptions about patient adherence to treatment on the provider level. For example, the references to [their] seeking [pain medication], [they] had many urine drug screens, no findings of narcotics use, only marijuana." Similarly, in the case of a person of color who had substance use disorder and who faced numerous challenges, CT MMR abstractor commented on "cultural incompetence [...]" at provider and facility levels, language dismissing concerns at provider level, undertreatment, and inadequate

discharge planning.” Undertreatment extended to a failure to administer Narcan in the case of a person of color with an active polysubstance use disorder who was found unresponsive for suspected overdose.

One case exemplified discrimination based on the person’s weight, although again, factors such as the decedents’ socioeconomic status and race/ethnicity are likely to have played a role in the discrimination. In their write-up, CT MMR abstractor highlighted negative patient-provider/facility interactions, including “many comments regarding [the decedent’s] body habitus and how exams or imaging were limited by this.”

Data on health disparities indicate that structural racism continues to play a role in people’s health and deaths in Connecticut.^{35,36} Given the small number of pregnancy-associated deaths in Connecticut, CT MMR project evaluators decided not to compute mortality ratios by race/ethnicity. With that said, available data point to a likely overrepresentation of persons of color, and especially Black persons, among all pregnancy-associated deaths, which is consistent with other racial and ethnic health disparities in the state.^{32,35,36}

Obesity

Since 2015, CT MMRC has considered the contribution of obesity to each pregnancy-associated death, regardless of its relatedness to pregnancy or preventability. However, because pre-pregnancy body mass index (BMI) was missing in about 20% of cases ($n = 13/62$), either because persons did not seek prenatal care or because prenatal records were unavailable, it was not possible to accurately assess the role that obesity played in people’s deaths. Out of 13 persons for whom pre-pregnancy BMI was missing, six persons were determined, based on BMIs recorded during pregnancy, to have not had obesity. Hence, whether a person had obesity was unknown in seven cases. In over one-quarter of cases ($n = 18/62$) it was known that decedents had BMIs within the obesity range, and in another quarter of cases ($n = 15/62$) it was known that decedents had BMIs within the overweight range.

The Committee determined that obesity contributed to five pregnancy-associated deaths; four decedents had obesity prior to the index pregnancy, and one was overweight (with a BMI bordering obesity range). Additionally, the Committee determined that obesity *probably* contributed to another six deaths; all six of those decedents had obesity before the index pregnancy.

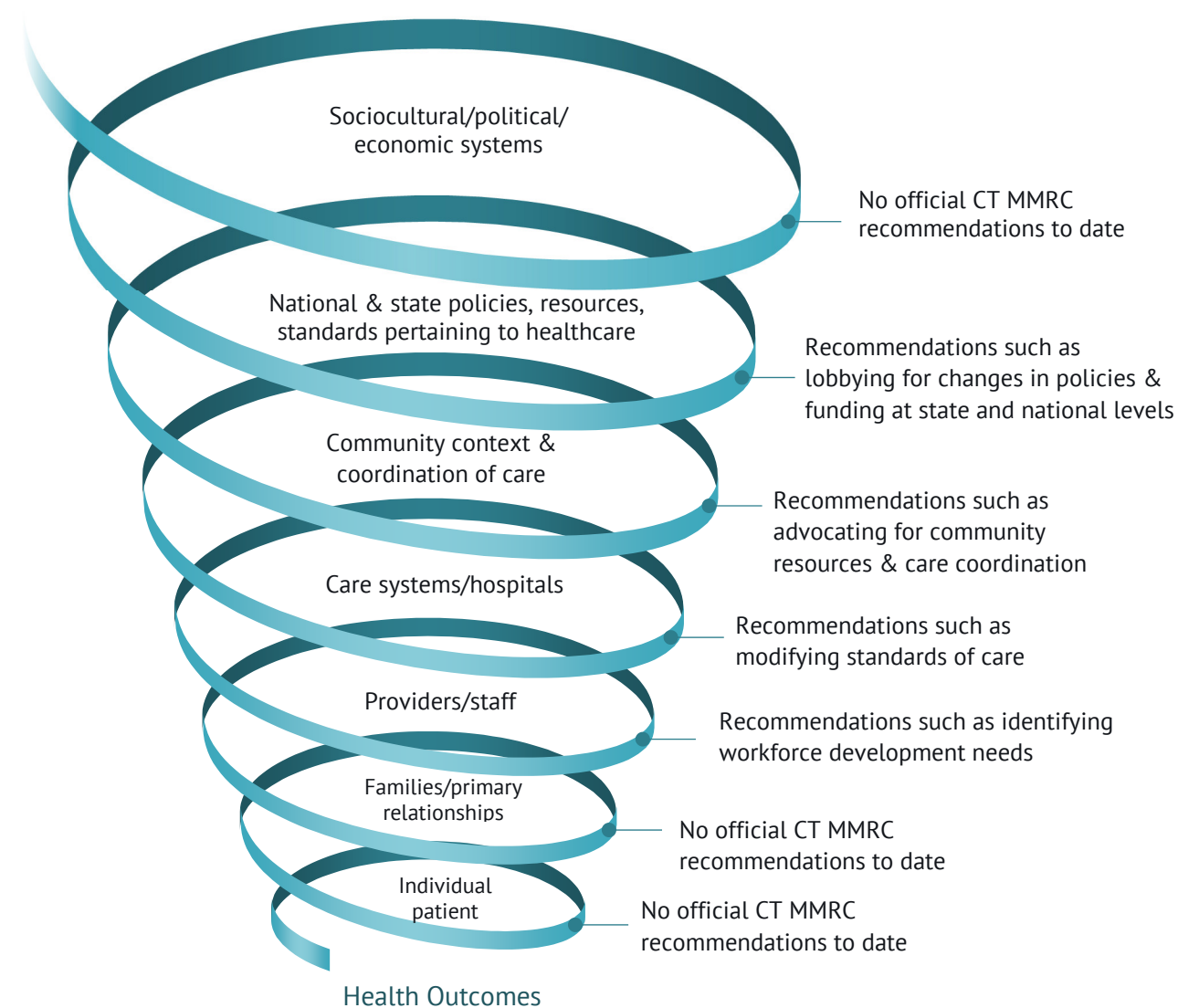
Obesity contributed to four out of 25 pregnancy-related deaths, and *probably* contributed to one pregnancy-related death. All five deaths to which obesity contributed (four of which were pregnancy-related) were determined to be preventable. Death occurred during pregnancy in one case and in postpartum in four cases. Causes of death were medical diseases in all instances, and the manner of death was natural for all five cases.

CT MMRC Recommendations

A key aspect of the death review process involves the development of recommendations for preventative action. In developing recommendations, CT MMRC focuses on pregnancy-related deaths that are determined to be preventable. The process involves, first, ongoing descriptive analyses of all deaths reviewed by CT MMRC; second, a qualitative analysis of factors contributing to the death and working recommendations for prevention proposed during Committee meetings (Figure D-1); third, a review, discussion, and revisions by the Committee of analyzed and sorted recommendations; and fourth, the Committee’s vote on recommendations, followed by additional wordsmithing and voting, as needed.

FIGURE D-1

Contextual Multisystemic Framework for CT MMRC Recommendations



Working recommendations pertaining to deaths that occurred between 2015 and 2019 were sorted using a contextual multisystemic framework, with an aim of identifying the target of each suggested intervention. The framework comprises seven interconnected levels, or points of intervention, as shown in Figure D-1. Considering recommendations within this framework provides a way to conceptualize systems of systems. This means focusing not only on each individual system (or level within the framework), but also on how systems affect one another in ways that both support and constrain opportunities for change. For example, it may be important to increase the time a provider (eg, doctor, nurse, social worker) spends with each patient to be able to adequately screen for mental health, substance use, and intimate partner violence. This type of change may be constrained by hospital and care system protocols and practices, which may in turn be constrained by the economics of health care. To give another example, ensuring that communities have adequate treatment facilities for those who are pregnant or postpartum may be constrained by the economics of health care, on one hand, but supported by national and state initiatives that call for and provide funding for such care, on the other hand. Systems at all levels have patterns, rules, power dynamics, and relational processes that may or may not support recommendations for improvement.

To date, CT MMRC has made multiple recommendations at the levels of provider/staff, care systems/hospitals, community context/coordination of care, and broader state and community supports. On September 8, 2020, CT MMRC issued its first set of 6 recommendations based on reviews of deaths that occurred between 2015 and 2017. On October 7, 2021, CT MMRC approved an additional set of 21 recommendations based on deaths that occurred between 2015 and 2019. All 27 recommendations are listed in Table D-1.

TABLE D-1

CT MMRC Recommendations

The committee issued 6 recommendations in September 2020 and 21 recommendations in October 2021. Recommendations from September 2020 are marked with an asterisk; they were included in the Committee’s first annual report, in December 2020, and are reprinted here for the sake of reference.

Provider & Staff	
Increase Provider Education	<p>The CT MMRC recommends that:</p> <ol style="list-style-type: none"> 1) The Connecticut Perinatal Quality Collaborative (CPQC) and Connecticut Hospital Association (CHA) offer, through the Alliance for Innovation on Maternal Health (AIM) Hypertension (HTN) bundle, provider training to increase awareness of health care needs, follow-up, and the significance of hypertensive disorders among pregnant and postpartum persons. <ol style="list-style-type: none"> a. CPQC and CHA provide obstetrics and gynecology providers with education about the importance of ensuring a referral to primary care providers, both during

	<p>pregnancy and in the postpartum period, for persons with high blood pressure during pregnancy.</p> <p>b. CPQC and CHA educate primary care providers regarding the significance of high blood pressure during pregnancy and the importance of following up after delivery with patients who have high blood pressure during pregnancy.</p> <p>2) The Governor’s Office coordinate the development of a web-based point of access portal for primary care providers and obstetrics and gynecology providers to refer patients to community resources such as, but not limited to, mental health treatment, substance use treatment programs, and home visiting programs.</p> <p>3) CSMS and CHA provide training for emergency department providers to raise awareness on how to make referrals for substance use and mental health treatment for pregnant and postpartum persons.</p> <p>4) CHA in partnership with birth hospitals provide ongoing training to obstetrics and gynecology providers on appropriate treatment for substance use during pregnancy.</p> <p>5) CSMS and CHA in partnership with birth hospitals provide training to educate emergency department providers on the significance of Group A Strep in pregnant and postpartum persons.</p> <p>6) CSMS and CHA educate providers about checking prescription drug monitoring programs and patients’ substance use history before prescribing opioids.</p> <p>7) Promote CDC’s <i>Hear Her</i> campaign to obstetricians and other obstetrics providers, hospital obstetrics units, and emergency departments.*</p> <p>8) The Connecticut Coalition Against Domestic Violence (CCADV) provide trainings to CT MMRC members on intimate partner violence.*</p> <p>9) CT MMRC subcommittee consisting of CCADV, DPH, and CSMS provide education to obstetric providers on available evidence-based screening tools for intimate partner violence, perinatal depression, and substance use disorder, and also available resources.*</p> <p>10) CT MMRC subcommittee consisting of CCADV, DPH, and CSMS provide education in hospitals to emergency department and social work staff as well as to obstetrics offices on indicators of intimate partner violence.*</p>
<p>Develop Medical Care (Provider) Protocols</p>	<p style="text-align: center;">Care Systems and Hospitals</p> <p>The CT MMRC recommends that:</p> <p>11) CT MMRC members lobby for an increased capacity of mobile crisis services to ensure 24/7 access.</p> <p>12) We recommend that CPQC, CHA, and birth hospitals ensure, via AIM venous thromboembolism (VTE) bundle, that hospital discharge plans provide education to</p>

	<p>patients on the importance of mobility following cesarean sections, as well as risks associated with immobility, and that providers are prescribing and documenting the use of anticoagulation and pneumatic compression boots for birthing persons at risk of VTE, including persons who have had cesarean sections and those who have had prolonged immobility.</p> <p>13) CHA and hospitals work to flag all critical lab reports collected in emergency departments with panic values to ensure results are reported promptly to ordering providers and/or primary care providers.</p> <p>14) CT MMR program staff develop a patient safety bundle for pregnant and postpartum persons with mental health disorders other than substance use disorder.</p>
<p>Improve Care Systems (Hospital) Protocols</p>	<p>The CT MMRC recommends that:</p> <p>15) CPQC ensure all birth hospitals have a policy in place about when to consult with maternal-fetal medicine.</p> <p>16) CHA, hospitals, and physician offices work to implement policies about screening consistently for social determinants of health – including, at a minimum, intimate partner violence, perinatal depression, and adverse childhood experiences – at initial emergency department and obstetrics and gynecology visits, over the course of pregnancy, and in the postpartum period.</p> <p>17) CHA and hospitals ensure policies are in place to provide discharge summaries and discharge instructions to primary care physicians, pediatricians, and treating obstetrics and gynecology providers.</p>

Community Context

<p>Improve Coordination of Care and Community Collaboratives</p>	<p>The CT MMRC recommends that:</p> <p>18) The Human Services Committee, Women and Girl’s Subcommittee propose a legislative mandate for all home visiting programs in Connecticut to enroll all birthing persons prenatally.</p> <p>19) The American College of Obstetricians and Gynecologists (ACOG) chapter in Connecticut provide ongoing training to educate obstetrics and gynecology providers about the importance of collaborating with home visiting programs to ensure outreach to pregnant persons when there is a lapse in prenatal care.</p> <p>20) The Office of Early Childhood (OEC) home visiting program conduct outreach to all obstetrics and gynecology providers to increase awareness about services offered through home visiting and how to refer patients.</p>
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State Policies, Resources & Standards

<p>Broader Level (State and</p>	<p>The CT MMRC recommends that:</p>
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Community) Supports	<ul style="list-style-type: none"><li data-bbox="396 197 1430 275">21) Department of Children and Families (DCF) provide support to all parents who are undergoing removal of a child and send a report to the patient’s obstetric provider.<li data-bbox="396 296 1430 373">22) Hospital social workers be involved with cases where the child is being removed and develop a post-partum plan and send it to the obstetric provider.<li data-bbox="396 394 1430 512">23) Hospital social workers provide parents with contact information for therapists and counselors when there is consideration for child removal or a temporary hold on infant discharge.<li data-bbox="396 533 1430 567">24) CT MMRC members lobby for increased inpatient psychiatric capacity in Connecticut.<li data-bbox="396 588 1430 665">25) CT MMRC members lobby for congregate care housing for pregnant and postpartum persons with mental health disorders other than substance use disorder.<li data-bbox="396 686 1430 764">26) Department of Social Services (DSS) consider extending Medicaid coverage to one year postpartum.*<li data-bbox="396 785 1430 863">27) DSS improve access to same day long-acting contraception in Federally Qualified Health Centers by adjusting Medicaid reimbursement.*
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Some Implications

The results of this review suggest that greater attention needs to be paid to identifying, intervening, and providing care for pregnant and postpartum persons in Connecticut who are struggling with mental health conditions, substance use disorder, and/or intimate partner violence. The use of the Utah criteria by CT MMRC helped clarify and emphasize the relationship between substance use and mental health, on one hand, and mortality, on the other hand, allowing a more accurate and complete picture to emerge. The CT MMRC recommendations in these key areas are in keeping with national goals.^{6,8} Future directions include developing more extensive measurements of factors associated with these deaths, as suggested in the National Quality Forum's *Maternal Morbidity and Mortality Measurement Recommendations* report.³⁷ For example, capturing families' experiences of care via in-depth interviews is likely to fill the gaps in our understanding of factors that contribute to the deaths, which, in turn, is likely to provide a clearer path for actionable recommendations. Finding ways to access and integrate these first-hand experiences into CT MMRC's recommendations is critical, and the CT MMR program is planning on doing so starting with deaths that will have occurred in 2021.

Health inequities in Connecticut based on race/ethnicity and social class are not receding and need to be comprehensively addressed across multiple systems levels. CT MMRC was able to highlight the persistence of racial disparities by adding to the review the contribution of discrimination to pregnancy-associated deaths. It will be important to continue to develop ways to measure and record racism as well as other types of discrimination. According to the National Quality Forum's 2021 report, "overarching concepts, especially racism, were too critically connected to preventable outcomes of maternal morbidity and mortality not to be measured independently."³⁷ Unlike racial disparities and racism,^{11,12,14,26,38-47} social class and socioeconomic marginalization have received little attention so far in the discourse on maternal mortality, notable exceptions notwithstanding.¹⁶ The striking overrepresentation of those with limited socioeconomic resources among pregnancy-related deaths in Connecticut calls for a careful assessment of the root causes of disparities in health outcomes and consideration of recommendations for action to address socioeconomic inequities.

CT MMRC's multisystemic framework provides a contextual lens through which to situate intervention recommendations. This provides ways to better understand the relationship between opportunities and constraints across multiple systems. It may also be helpful to consider recommendations in terms of first-, second-, and third-order systemic change processes.⁴⁸ In this case, first order change refers to modifications that are made to existing system practices, such as increasing consistency of intimate partner violence screening, providing information to women on risks of substance use during pregnancy, and increasing provider awareness of home visiting programs. First-order recommendations might be thought of as doing "a better job of what we do." Second-order change refers to change in system practices and protocols; in other words, "seeing and doing things differently in ways that change the system."⁴⁸ Examples of second-order recommendations might include improving provider-patient relationships by listening to pregnant women (as emphasized in CDC's *Hear Her* campaign), developing a patient safety bundle for mental health needs, providing trauma-informed care,⁴⁹ and

Implications

the American Hospital Association’s Task Force on Behavioral Health recommendation that “hospital leaders should review and evaluate the organization’s behavioral health plan in light of identified community needs, the behavioral health needs of their patients, and available community resources.”⁵⁰ Third-order change refers to changes in systems of systems; in this case, it is a change in how healthcare is conceptualized and delivered within the economic, societal, and political systems in which it is embedded. Recommendations at this level might include moving from fragmented, specialized healthcare to collaborative, integrated care.^{23,51,52}

Lastly, it is important to highlight most pregnancy-associated deaths, and nine out of ten pregnancy-related deaths, in Connecticut are preventable. Given that most of these deaths occur throughout the year-long postpartum period, CT MMRC’s recommendation to extend pregnancy-related care and Medicaid insurance coverage for a full year deserves serious consideration, as it is likely, if implemented, to increase the chances of preventing postpartum deaths.

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Appendix A: CT MMR Program

In Connecticut, the Department of Public Health (CT DPH) is the lead on initiatives that promote reproductive health, and has, as such, coordinated the Connecticut Maternal Mortality Review (MMR) program since the early 2000s. For a number of years, CT DPH administered the MMR program on a limited budget or at no cost. Scarce funds notwithstanding, in the period between late 2014 and 2016, the MMR program was able to, with support from the Connecticut State Medical Society (CSMS), review pregnancy-associated deaths that occurred between 2011 and 2013. The work of the MMR program stalled in 2017 because of staffing changes within CT DPH, the retirement of a physician who volunteered her time to abstract medical records, and administrative hurdles involved with contracting a new physician. Deaths that occurred in 2014 were not reviewed, and deaths that occurred in 2015 were reviewed only much later, in the winter of 2018/2019.

In 2018 the Connecticut General Assembly passed legislation granting statutory authority to CT DPH to convene a multidisciplinary Connecticut Maternal Mortality Review Committee (CT MMRC) for the purpose of not only reviewing pregnancy-associated deaths of state residents but also developing recommendations for preventative action (CGS §19a-25). The legislation stipulated that CT MMRC be co-chaired by the Commissioner of CT DPH, or the Commissioner's designee, and a representative designated by the CSMS. The legislation additionally listed the suggested Committee membership as follows:

- ◆ an obstetrician/gynecologist,
- ◆ a pediatrician,
- ◆ a community health worker,
- ◆ a nurse-midwife,
- ◆ a clinical social worker,
- ◆ a psychiatrist,
- ◆ a psychologist,
- ◆ the Chief Medical Examiner, or a designee,
- ◆ a member of the Connecticut Hospital Association,
- ◆ a representative of a community or regional program or facility providing services for persons with psychiatric disabilities or persons with substance use disorders, and
- ◆ a representative of The University of Connecticut-sponsored Health Disparities Institute.

Furthermore, the legislation included a provision for any additional members whose expertise might contribute to the death review process, as determined by the CT MMRC co-chairs. The newly constituted CT MMRC first convened in September 2018 and started reviewing pregnancy-associated deaths in December of the same year. Committee meetings were held quarterly through the first half of 2020, bi-monthly in the summer of 2020, and monthly thereafter in an effort to reduce the lag between the occurrence of each death and its review, as well as to develop timely recommendations for preventative action. Meetings are held in the evenings to accommodate the work schedules of Committee members who volunteer their time and expertise for the benefit of Connecticut's families.

Consistent with state legislation, Committee members included, and continue to include CT DPH and CSMS co-chairs, as well as a number of clinical and non-clinical providers representing a variety of professional disciplines.

More specifically, in addition to the members listed in the statute, representatives of the following professions and organizations have joined the Committee over the course of 2020 and 2021:

- ◆ a labor & delivery doula,
- ◆ an internal medicine physician,
- ◆ a representative of the Connecticut Coalition Against Domestic Violence,
- ◆ a consumer,
- ◆ a pediatrician,
- ◆ an emergency department physician,
- ◆ a cardiologist,
- ◆ a neonatologist,
- ◆ a Medicaid Advisory Council representative,
- ◆ a Department of Social Services representative,
- ◆ a Department of Mental Health & Addiction Services representative,
- ◆ a Department of Children and Families representative,
- ◆ an OB-GYN nurse manager,
- ◆ a home visiting provider,
- ◆ a Federally Qualified Health Center (FQHC) representative, and
- ◆ a Hospital Nurse Manager Women's Services representative.

CDC Grant

In the spring of 2019, the Centers for Disease Control and Prevention (CDC) issued a request for applications for funds to support the work of Maternal Mortality Review Committees (MMRC) across the country. The purpose of this funding opportunity was to assist MMRCs with obtaining the most detailed, complete data on causes and circumstances surrounding pregnancy-associated deaths in order to develop actionable recommendations to prevent such deaths in the future. CDC's expectations for grant recipients were as follows:

- 1) to identify all pregnancy-associated deaths within one year of death;
- 2) to abstract all relevant data and compile detailed case summaries;
- 3) to enter data on all pregnancy-associated deaths into a standard data system (Maternal Mortality Review Information Application, or MMRIA for short);
- 4) to conduct multidisciplinary reviews in accordance with CDC's guidelines;
- 5) to enter committee decisions into MMRIA within two years of death;
- 6) to conduct quality assurance processes to ensure data quality, completeness, and timeliness; and
- 7) to analyze data and share findings with stakeholders to inform policy and practice.

Connecticut Department of Public Health MMR program applied for CDC funds in May of 2019 and was granted an award in August of 2019 for the period between October 2019 and September 2023. As of this writing, Connecticut's MMR program is using the funds to support CT DPH staff and to contract with a nurse abstractor, an evaluator, and marketing support.

Prior to the CDC grant, the CT MMRC CSMS co-chair, a maternal-fetal medicine specialist, volunteered a considerable amount of time to abstract medical records and other relevant information related to pregnancy-

associated deaths of Connecticut residents and to write detailed case summaries. With CDC funding, Connecticut's MMR program has been able to contract with a nurse abstractor, who has taken over this set of tasks. It is worth noting at this point that detailed case summaries are essential for the Committee's review of pregnancy-associated deaths. They have allowed for more accurate discernment of factors that contribute to pregnancy-associated deaths, and therefore, better-informed recommendations for preventing, and ultimately eliminating, maternal mortality in the state.

As the CDC funds became integrated into the daily operations of Connecticut's MMR program, CT DPH staff and the nurse abstractor started entering abstracted information on pregnancy-associated deaths into MMRIA, the CDC's data system for monitoring maternal mortality in the US. An evaluator was contracted to perform data quality assurance checks in order to assess completeness, accuracy, and timeliness of data entered into MMRIA. Additionally, the evaluator was tasked with analyzing data on pregnancy-associated deaths, assessing the work of the CT MMRC, and reporting on the findings.

Throughout the project period, the MMR program has and will continue to work with a media company to develop educational materials aimed at both the medical community and the general public. Media support will be utilized to build awareness of CT MMRC's recommendations and to educate the general public on the efforts to eliminate maternal mortality in Connecticut.

Lastly, with CDC's support, Connecticut's MMR program was able to prepare this report and will continue to issue annual reports, as mandated by the state statute, to inform policy makers on the Committee's findings and recommendations.

CT MMRC Review Process

CT MMRC reviews all deaths of Connecticut residents that occur during pregnancy or within one year of the end of pregnancy, regardless of the cause. These are known as pregnancy-associated deaths. The process of reviewing pregnancy-associated deaths comprises four distinct phases, as outlined in the paragraphs that follow.

I. IDENTIFICATION OF PREGNANCY-ASSOCIATED DEATHS

The review of pregnancy-associated deaths starts with their identification. In Connecticut, Surveillance Analysis and Reporting (SAR) Unit in the Health Statistics and Surveillance section at CT DPH is responsible for generating a list of potential pregnancy-associated deaths. The SAR staff members do so by linking death certificates of women under 61 years of age to infants' birth certificates and fetal death certificates, using string similarity functions to assign a matching score based on social security number, date of birth, and the decedent's first, last, and maiden name. Matched pairs with matching scores above a pre-specified cutoff are then manually reviewed by the SAR staff to verify the linkage.^{viii} Additional deaths are identified from death certificates using information from the pregnancy checkbox or the underlying cause of death ICD-10 codes related to pregnancy (O00-O99).^{ix}

For deaths that occurred in 2015 through 2018, SAR provided MMR staff with final or near-final lists of potential pregnancy-associated deaths. Starting with deaths that occurred in 2019, the SAR Unit provided both

provisional and final lists to increase the timeliness of the death review process. An additional facilitating factor is the transition from paper to electronic death records, which will be completed by December 2021; electronic death records allow for death certificates to be linked to infants' birth certificates or fetal death certificates before the annual death file is finalized, which has further decreased the lag between deaths and their review by CT MMRC. What is more, electronic death records allow for a search of key terms in the literal cause of death field, which may further expand the pool of potential pregnancy-associated deaths.

Having compiled the list of potential pregnancy-associated deaths, the SAR staff send it, via a secure transmission protocol, to the MMR program staff and the nurse abstractor, who, in turn, work on obtaining death and birth certificates, medical examiner reports, and hospital and medical records. Based on the information from medical examiner reports, medical records, and other sources, the MMR program staff then determine which cases from the SAR list are veritable pregnancy-associated deaths and which are included on the list because of pregnancy checkbox errors or ICD-10 code errors.

II. ABSTRACTION OF INFORMATION

The second phase of the review process involves obtaining additional information on each pregnancy-associated case—emergency room records, medical transport records, obituaries, funeral home records, social media network postings, and as necessary, police reports—and entering all information into MMRIA, a data system for monitoring maternal mortality in the US. A nurse abstractor reviews and abstracts information from all available records and compiles detailed narratives for pregnancy-associated deaths. The narratives include not only medical data but also any available information on decedents' supports, challenges, housing, resources, and relationships. The CSMS CT MMRC co-chair, a maternal-fetal medicine specialist, reviews the case narratives for completeness and clarity, and provides feedback to the nurse abstractor, who then makes revisions and sends them to the MMR program staff. To ensure confidentiality of the process, the DPH CT MMRC co-chair removes all personally identifying information from the narratives prior to distributing them to Committee members, and additionally, collects signed confidentiality pledges from all members at least once a year. Case narratives are sent to Committee members several days before each CT MMRC meeting.

III. DISCUSSION OF PREGNANCY-ASSOCIATED DEATHS

The third phase of the review process involves multidisciplinary discussion of pregnancy-associated deaths during CT MMRC meetings. Meetings are held bi-monthly or more frequently, if needed, and are scheduled in the evenings to accommodate Committee members' professional commitments. The goal is to review 5 cases at each meeting.

In accordance with CDC's guidelines, the *Committee Decisions Form*²⁸ is used as an organizing principle for case discussions. Each discussion starts with the CSMS co-chair reading the case summary aloud, followed by Committee members' questions and an exchange of opinions. The CSMS co-chair then guides the conversation toward decision-making on three key questions:

- 1) what was the underlying cause of death?
- 2) was the death pregnancy-related?

3) was the death preventable?

Definitions of concepts, such as pregnancy-relatedness and preventability, are presented via Power Point slides, and at times read aloud, after which a vote is taken on each question. All Committee members participate in the vote. If a qualified majority of at least 67 percent is not achieved, the discussion is reopened and is followed by a second vote. Reaching plurality the second time around is deemed sufficient for a response choice (eg, “yes, “probably,” or “no”) to be selected and marked as the Committee’s decision.

It is important to emphasize that CT MMRC is using standard concept definitions, which are listed on CDC’s *Committee Decisions Form*, to guide Committee members’ decision-making on the questions of interest.²⁸ Namely, underlying cause of death is defined as “the disease or injury that initiated the chain of events leading to death or the circumstances of the accident or violence which produced the fatal injury.”²⁸ The cause of death listed on a death certificate is, at least in theory, the underlying cause of death. Hence, the discussion of this topic during the CT MMRC meetings typically involves a confirmation of the cause of death listed on a death certificate. There have been, however, instances of a different underlying cause of death being identified by the Committee.^x

A death is considered preventable if the Committee determines that “there was at least some chance of the death being averted by one or more reasonable changes to patient, family, facility, system and/or community factors.”²⁸

A death is classified as pregnancy-related if it occurs “during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.”²⁸ By contrast, a death is classified as pregnancy-associated but not pregnancy-related if it happens “during pregnancy or within one year of the end of pregnancy from a cause that is not related to pregnancy.”²⁸ Pregnancy-associated deaths for which pregnancy-relatedness cannot be determined are classified as “pregnancy-associated but unable to determine relatedness.”²⁸

Besides voting on the three key questions, the Committee votes on factors that may have contributed to the death—obesity, discrimination, mental health conditions, and substance use disorder—and, for non-natural deaths, the manner of death (ie, suicide and homicide). For deaths that are determined to be preventable and pregnancy-related (ie, causally related to pregnancy), case discussion covers three additional key questions:

- 4) what were the contributing factors to the death?
- 5) what are the recommendations and actions that address those contributing factors?
- 6) what is the anticipated impact of those actions if implemented?

Answers to these and all other questions are recorded on the CDC’s *Committee Decisions Form* and entered into MMRIA, the CDC’s data system for monitoring maternal mortality in the US, within a week after each CT MMRC meeting.

IV. DEVELOPMENT OF RECOMMENDATIONS

The last phase in the review process involves the development of CT MMRC recommendations for action to prevent pregnancy-related deaths. The process starts with, first, ongoing descriptive analyses of all deaths reviewed by CT MMRC; the analyses include breakdowns by pregnancy-relatedness and preventability, as well as other key variables identified by the CT MMRC leadership. The second step involves a listing and review of contributing factors and working recommendations proposed during Committee meetings. This is followed by a qualitative analysis that includes a sorting of recommendations, which is informed by a contextual multisystemic framework to identify the target of each suggested intervention. The third step consists of the Committee's review, discussion, and revisions of analyzed and sorted recommendations. Lastly, the Committee votes on the recommendations, followed by additional wordsmithing and voting in cases of disagreement.

To date, three Committee meetings were devoted to the development of official CT MMRC recommendations: in September 2020, in April 2021, and in September 2021. The September 2020 meeting resulted in the first set of official CT MMRC recommendations; this set included six recommendations that were based on the Committee's review of preventable, pregnancy-related deaths that occurred between 2015 and 2017. The meetings held in April and September of 2021 were devoted to the review, discussion, and revisions of the second set of official CT MMRC recommendations; the second set included 21 recommendations that were based on the Committee's review of preventable, pregnancy-related deaths that occurred between 2015 and 2019. The final vote for the second set of recommendations was held via a web-based portal in October 2021.

Appendix B: The Utah Criteria

Standardized Decision-Making Criteria for Mental Health and Substance Use-Related Deaths²

Pregnancy Complications

- 1a) Increased pain directly attributable to pregnancy or postpartum events (eg, back pain, pelvic pain, UTI/kidney stones, cesarean incision or perineal tear pain) leading to self-harm and/or use of prescribed or illicit drug use that are implicated in subsequent suicide or accidental death.
- 1b) Traumatic event in pregnancy or postpartum (stillbirth, preterm delivery, diagnosis of fetal anomaly, 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.
- 1c) Pregnancy related complication (preeclampsia/eclampsia, placental abruption) likely exacerbated by drug use leading to subsequent death.

Chain of Events Initiated by Pregnancy

- 2a) Cessation or attempted taper of substance use treatment/pharmacotherapy (eg, methadone or buprenorphine) for pregnancy-related concerns (eg, fetal risk, fear of child protective service involvement) leading to maternal destabilization, self-harm and/or drug use and subsequent death.
- 2b) Cessation of medications (eg, chronic pain medications, psychiatric medications) due to pregnancy-related concerns (eg, neonatal withdrawal, fetal growth, congenital anomalies) leading to maternal destabilization, self-harm and/or drug use and subsequent death.
- 2c) Inability to access inpatient or outpatient drug or mental health treatment due to pregnancy (eg, providers uncomfortable with treating pregnant women, facilities not available that accept pregnant women).
- 2d) Post-partum depression, anxiety or psychosis resulting in maternal destabilization, self-harm and/or drug use and subsequent death.
- 2e) Recovery/stabilization achieved during pregnancy or postpartum with clear statement in records that pregnancy was motivating factor with subsequent relapse and overdose due to decreased tolerance and/or multiple drug use (prescribed opioids and illicit or misused opioids) and subsequent death.

Aggravation of an Unrelated Condition by the Physiologic Effects of Pregnancy

- 3a) Worsening of underlying depression, anxiety, or other psychiatric condition in pregnancy or postpartum period with documentation that mental illness led to self-harm and/or drug use and subsequent death.
- 3b) Exacerbation, under-treatment or delayed treatment of pre-existing condition (eg, chronic pain) in pregnancy or postpartum leading to self-harm and/or use of prescribed or illicit drugs resulting in death.
- 3c) Medical conditions secondary to drug use (stroke or cardiovascular arrest due to stimulant use) in setting of pregnancy or postpartum that may be attributable to pregnancy-related physiology and increased risk of complications leading to death.

Appendix C: Methods

CT MMR program staff enter and store data on pregnancy-associated deaths in the Maternal Mortality Review Information Application (MMRIA). Developed by CDC and the CDC Foundation, MMRIA is housed on a secure server and is available, free of charge, to all state maternal mortality review committees. Data entered into MMRIA include information listed on birth/fetal death certificates and death certificates; autopsy reports; medical records; police reports; abstractors' case narratives; and committee decisions. CT MMRC did not use interviews with family members and other informants in the review of deaths that occurred between 2015 and 2019. Interview data will be collected, and entered into MMRIA, starting with deaths that occurred in 2021.

For the purpose of this report, data were extracted from MMRIA by CT MMR project evaluators and analyzed using SAS software. Analysis included calculation of mortality ratios and descriptive statistics pertaining to maternal demographic characteristics, circumstances of death, and committee decisions. CT MMR project evaluators calculated mortality ratios for all pregnancy-associated deaths, as well as for the subset of deaths that were determined by CT MMRC to be pregnancy-related. Mortality ratios serve to quantify mortality during pregnancy or in the postpartum period among Connecticut residents; they also allow for comparisons with other states, and they will be used, eventually, to track trends over time in Connecticut.

Mortality ratios were calculated as the number of deaths per 100,000 live births, as reported by CT DPH Vital Records Office, for the five-year period between 2015 and 2019. Additionally, 95% confidence limits were computed, using the gamma method, to quantify random variation associated with mortality ratios. Although they are based on complete counts, mortality ratios provided in this report may be affected by random variation. This means that “the number of deaths that actually occurred may be considered as one of a large series of possible results that could have arisen under the same circumstances.”⁵³ Random variation tends to be large in instances in which the number of deaths is small (fewer than 100), as was the case in Connecticut in the period between 2015 and 2019 (there were 25 pregnancy-related deaths). Hence, there is uncertainty around the pregnancy-related mortality ratio of 14.2 per 100,000 in 2015-2019, and the 95% confidence limits suggest that the chances are 95 in 100 that the actual mortality ratio for pregnancy-related deaths was anywhere between 9.2 and 21.0 per 100,000.

Another consideration is the adoption of standardized decision-making criteria for determining pregnancy-relatedness of deaths due to mental health conditions, including substance use disorder, and accidental overdoses.² These criteria are known in Connecticut as the Utah criteria. Starting with deaths that occurred in 2018, CT MMRC used the Utah criteria during their deliberations on pregnancy-relatedness. Doing so likely resulted in a greater number of pregnancy-related determinations for deaths that occurred in 2018-2019 than would have been the case otherwise.

For deaths that occurred in 2015-2017, prior to the adoption of the Utah criteria, CT MMRC determined all three suicides and none of the accidental overdoses to be pregnancy-related. Two CT MMR evaluation

researchers, both of whom have a background in mental health, retrospectively applied the Utah criteria to all pregnancy-associated deaths that occurred in 2015-2017. The researchers first read case narratives independently of one another; they then met to compare their retrospective assignments of pregnancy-relatedness based on the Utah criteria; and lastly, they discussed the differences in assignments until a consensus could be reached. Through this process, they identified five deaths that were determined by CT MMRC to be not pregnancy-related but that likely would have received a pregnancy-related designation had the Utah criteria been in force.

Consistent with the Committee's approach for pregnancy-relatedness determination for deaths that occurred in 2015-2017, all three suicides that occurred in 2018-2019 were determined by CT MMRC to be pregnancy-related. In a departure from the Committee's original approach, and under the influence of the Utah criteria, four accidental overdoses and one death due to chronic substance use—close to half of all substance use-related deaths in 2018-2019—were determined by CT MMRC to be pregnancy-related. It is also noteworthy that the Committee could not determine pregnancy-relatedness for accidental overdoses that occurred in 2018-2019.

In addition to mortality ratios, the analysis of MMRIA data included descriptive statistics (counts, percentages, and averages) pertaining to decedents' demographic characteristics (year of death, age, race/ethnicity, employment, health insurance, education); circumstances of death (manner, timing, location of death); and committee decisions (pregnancy-relatedness, preventability, cause of death, factors contributing to the death, recommendations).

Information about decedents' age at death was obtained from death records. Data on other demographic characteristics were obtained from birth or fetal death records, and in cases in which such information was not available, from death records. Birth and death record data were checked against medical records and other available data, and in three cases, CT MMR leadership in consultation with CT MMR project evaluators decided to report on data from sources other than birth records (one person had race listed as "White" in the birth record, but "African American" on all medical records; one person had education listed as "Master's degree" in the birth record, but this was re-coded as "unknown" based on other available information; one person had health insurance listed as "unknown" in the birth record, but this was re-coded as "Medicaid" based on medical records). For the purpose of this report, two CT MMR project evaluators categorized decedents' jobs, as listed on the death certificates, using the Equal Employment Opportunity (EEO) categories. They first completed the categorization independently from each other, and then met to compare their decision-making; differences were resolved through discussion until a consensus could be reached.

Data on circumstances of death were obtained from death records and cross-checked against case narratives. In eight cases in which there was a discrepancy between the death record and the case narrative concerning the location of death data, information from the case narratives was used for the purpose of this report. For deaths that occurred during pregnancy, timing of death relative to pregnancy was based on CT MMR abstractors' timing assignments, which were informed by medical records and autopsy reports. For deaths that occurred

postpartum, timing of death was calculated by comparing the date of death listed on the death record and the date of delivery listed on birth or fetal death record. Cause of death was obtained from the Committee Decision Form for pregnancy-related deaths and from the death record for all other deaths. CT MMR leaders, both of whom have a medical background, categorized causes of death for all deaths using the groupings from CDC's *Report from Nine Maternal Mortality Review Committees*.³ Information about CT MMRCs review of deaths was obtained from the Committee Decision Form.

Qualitative Analysis

Two CT MMR project evaluators who have extensive research experience completed a qualitative analysis of pregnancy-associated deaths that occurred between 2015 and 2019. The analysis centered on cases in which the manner of death was either homicide or suicide, and deaths to which substance use disorder or other mental health conditions contributed. Notably, deaths for which CT MMRC determined that substance use disorder or other mental health conditions were *probably* a contributing factor were excluded from the analysis because of paucity of relevant information about the circumstances of death (which is why CT MMRC members settled on “probably” rather than “yes” in responding to the questions about the contribution of substance use disorder and mental health conditions to the death).

Evaluators reviewed all pregnancy-associated deaths that met aforementioned criteria, regardless of pregnancy-relatedness, in order to capture as robust a picture as possible of the experience and care received by Connecticut residents during the period under study. Data sources included CT MMRC case narratives and online information when available (ie., newspaper articles and public testimony). Recent literature on maternal mortality was consulted prior to and throughout the analysis. All case narratives were read and re-read to develop deep understanding and to identify themes. Newspaper articles and public testimony were searched online,^{xi} tied to specific case narratives when available, and reviewed for additive and/or clarifying information. Once themes were identified and agreed upon, case narratives were imported into Atlas.ti software, re-read, and coded to track the frequency of each theme across all case narratives. Identifiers were removed and the use of rich text in results was condensed to maintain anonymity.

The analysis of these retrospective case narratives was limited by lack of available information, inconsistency between the amount and type of information provided across case narratives, and absence of the voices of those whose experience researchers were attempting to represent. The low number of pregnancy-associated deaths by suicide and by homicide also limit confidence in identifying themes. Results are shared in this report in terms of themes despite low numbers, however, to provide readers with as much insight into the data as possible.

Appendix D: Legislation

Connecticut Maternal Mortality Review Legislation

Public Act No. 18-150

AN ACT ESTABLISHING A MATERNAL MORTALITY REVIEW PROGRAM AND COMMITTEE WITHIN THE DEPARTMENT OF PUBLIC HEALTH

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Section 19a-25 of the general statutes is repealed and the following is substituted in lieu thereof (Effective October 1, 2018):

All information, records of interviews, written reports, statements, notes, memoranda or other data, including personal data as defined in subdivision (9) of section 4-190, procured by the Department of Public Health, [\[or\]](#) by staff committees of facilities accredited by the Department of Public Health [or the maternal mortality review committee, established pursuant to section 3 of this act](#), in connection with studies of morbidity and mortality conducted by the Department of Public Health, [\[or\]](#) such staff committees [\[,\] or the maternal mortality review committee](#), or carried on by said department, [\[or\]](#) such staff committees [or the maternal mortality review committee](#) jointly with other persons, agencies or organizations, or procured by the directors of health of towns, cities or boroughs or the Department of Public Health pursuant to section 19a-215, or procured by such other persons, agencies or organizations, for the purpose of reducing the morbidity or mortality from any cause or condition, shall be confidential and shall be used solely for the purposes of medical or scientific research and, for information obtained pursuant to section 19a-215, disease prevention and control by the local director of health and the Department of Public Health. Such information, records, reports, statements, notes, memoranda or other data shall not be admissible as evidence in any action of any kind in any court or before any other tribunal, board, agency or person, nor shall it be exhibited or its contents disclosed in any way, in whole or in part, by any officer or representative of the Department of Public Health or of any such facility, by any person participating in such a research project or by any other person, except as may be necessary for the purpose of furthering the research project to which it relates. Notwithstanding the provisions of chapter 55, the Department of Public Health may exchange personal data for the purpose of medical or scientific research, with any other governmental agency or private research organization; provided such state, governmental agency or private research organization shall not further disclose such personal data. The Commissioner of Public Health shall adopt regulations consistent with the purposes of this section to establish the procedures to ensure the confidentiality of such disclosures. The furnishing of such information to the Department of Public Health or its authorized representative, or to any other agency cooperating in such a research project, shall not subject any person, hospital, sanitarium, rest home, nursing home or other person or agency furnishing such information to any action for damages or other relief because of such disclosure. This section shall not be deemed to affect

disclosure of regular hospital and medical records made in the course of the regular notation of the care and treatment of any patient, but only records or notations by such staff committees pursuant to their work.

Sec. 2. (NEW) (*Effective October 1, 2018*) (a) As used in this section and section 3 of this act, "maternal death" means the death of a woman while pregnant or not later than one year after the date on which the woman ceases to be pregnant, regardless of whether the woman's death is related to her pregnancy, and "department" means the Department of Public Health.

(b) There is established, within the department, a maternal mortality review program. The program shall be responsible for identifying maternal death cases in Connecticut and reviewing medical records and other relevant data related to each maternal death case, including, but not limited to, information collected from death and birth records, files from the Office of the Chief Medical Examiner, and physician office and hospital records.

(c) Licensed health care providers, health care facilities and pharmacies shall provide the maternal mortality review program, established under this section with reasonable access to all relevant medical records associated with a maternal death case under review by the program.

(d) All information obtained by the department for the maternal mortality review program shall be confidential pursuant to section 19a-25 of the general statutes, as amended by this act.

(e) Notwithstanding subsection (d) of this section, the department may provide the maternal mortality review committee, established pursuant to section 3 of this act, with information as is necessary, in the department's discretion, for the committee to make recommendations regarding the prevention of maternal death.

Sec. 3. (NEW) (*Effective October 1, 2018*) (a) There is established a maternal mortality review committee within the department to conduct a comprehensive, multidisciplinary review of maternal deaths for purposes of identifying factors associated with maternal death and making recommendations to reduce maternal deaths.

(b) The cochairpersons of the maternal mortality review committee shall be the Commissioner of Public Health, or the commissioner's designee, and a representative designated by the Connecticut State Medical Society. The cochairpersons shall convene a meeting of the maternal mortality review committee upon the request of the Commissioner of Public Health.

(c) The maternal mortality review committee may include, but not be limited to, any of the following members, as needed, depending on the maternal death case being reviewed:

(1) A physician licensed pursuant to chapter 370 of the general statutes who specializes in obstetrics and gynecology, appointed by the Connecticut State Medical Society;

(2) A physician licensed pursuant to chapter 370 of the general statutes who is a pediatrician, appointed by the Connecticut State Medical Society;

- (3) A community health worker, appointed by the Commission on Equity and Opportunity;
 - (4) A nurse-midwife licensed pursuant to chapter 377 of the general statutes, appointed by the Connecticut Nurses Association;
 - (5) A clinical social worker licensed pursuant to chapter 383b of the general statutes, appointed by the Connecticut Chapter of the National Association of Social Workers;
 - (6) A psychiatrist licensed pursuant to chapter 370 of the general statutes, appointed by the Connecticut Psychiatric Society;
 - (7) A psychologist licensed pursuant to chapter 20-136 of the general statutes, appointed by the Connecticut Psychological Association;
 - (8) The Chief Medical Examiner, or the Chief Medical Examiner's designee;
 - (9) A member of the Connecticut Hospital Association;
 - (10) A representative of a community or regional program or facility providing services for persons with psychiatric disabilities or persons with substance use disorders, appointed by the Commissioner of Public Health;
 - (11) A representative of The University of Connecticut-sponsored health disparities institute; or
 - (12) Any additional member the cochairpersons determine would be beneficial to serve as a member of the committee.
- (d) Whenever a meeting of the maternal mortality review committee takes place, the committee shall consult with relevant experts to evaluate the information and findings obtained from the department pursuant to section 2 of this act and make recommendations regarding the prevention of maternal deaths. Not later than ninety days after such meeting, the committee shall report, to the Commissioner of Public Health, any recommendations and findings of the committee in a manner that complies with section 19a-25 of the general statutes, as amended by this act.
- (e) All information provided by the department to the maternal mortality review committee shall be subject to the provisions of section 19a-25 of the general statutes, as amended by this act.

Approved June 12, 2018

Acronyms

ACOG	American College of Obstetricians and Gynecologists
AIM	Alliance for Innovation on Maternal Health
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CHA	Connecticut Hospital Association
CPQC	Connecticut Perinatal Quality Collaborative
CSMS	Connecticut State Medical Society
CT	Connecticut
DCF	Department of Children and Families
DMHAS	Department of Mental Health and Addiction Services
DPH	Department of Public Health
DSS	Department of Social Services
ERASE MM	Enhancing Reviews and Surveillance to Eliminate Maternal Mortality
HHS	United States Department of Health and Human Services
HTN	Hypertension bundle
MMR	Maternal Mortality Review
MMRIA	Maternal Mortality Review Information Application
MMRC	Maternal Mortality Review Committee
NCHS	National Center for Health Statistics
OCME	Office of the Chief Medical Examiner
OEC	Office of Early Childhood
PMSS	Pregnancy Mortality Surveillance System
PRMR	Pregnancy-Related Mortality Ratio
SAMHSA	Substance Abuse and Mental Health Services Administration
SAR	Surveillance Analysis and Reporting Unit, Department of Public Health
UConn	University of Connecticut
US	United States
VTE	Venous thromboembolism bundle
VNA	Visiting Nurse Association

Key Terms

Connecticut Maternal Mortality Review Committee (CT MMRC)	A multidisciplinary committee convened by the Connecticut Department of Public Health to review deaths that occur during pregnancy or within one year of the end of pregnancy in order to determine pregnancy-relatedness, identify contributing factors, and develop recommendations to prevent future deaths.
Connecticut Maternal Mortality Review (CT MMR) program	Situated within the Connecticut Department of Public Health, CT MMR program identifies pregnancy-associated deaths of Connecticut residents; obtains information from birth and death certificates, medical and hospital records, medical examiner reports, police reports, newspaper articles, and social media postings; prepares de-identified case narratives for committee review; conducts analyses of data on pregnancy-associated deaths; and supports the development and implementation of recommendations for action to prevent pregnancy-related deaths in the future.
Pregnancy-associated death	The death that occurs during pregnancy or within one year of the end of pregnancy, regardless of the cause.
Pregnancy-related death	The death that occurs during pregnancy or within one year of the end of pregnancy from any cause related to or aggravated by the pregnancy or its management.
Pregnancy-associated but not pregnancy-related death	The death that occurs during pregnancy or within one year of the end of pregnancy from a cause unrelated to pregnancy.
Pregnancy-associated mortality ratio	The number of pregnancy-associated deaths per 100,000 live births.
Pregnancy-related mortality ratio	The number of pregnancy-related deaths per 100,000 live births
Maternal Mortality Review Information Application (MMRIA)	A data system designed to facilitate Maternal Mortality Review Committee functions through a common data language. MMRIA was developed by the Centers for Disease Control and Prevention in partnership with maternal mortality review subject experts throughout the United States. It is available, at no cost, to Maternal Mortality Review Committees in the United States.
Maternal death	The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

End Notes

ⁱ The National Center for Health Statistics uses data from the National Vital Statistics System to determine the official maternal mortality rate for the United States. The maternal mortality rate represents maternal deaths, which are defined the World Health Organization as the deaths of women during pregnancy or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. For 2018, the United States official maternal mortality rate reported by the National Center for Health Statistics was 17.4 deaths per 100,000 live births; for 2019, it was 20.1 deaths per 100,000 live births, a statistically significant increase from 2018. Notably, because of a relatively small number of maternal deaths each year (658 in 2018 and 754 in 2019), maternal mortality rates are subject to random variation. Additionally, rates may differ from year to year because of errors on death certificates.

ⁱⁱ Healthy People 2030 objective MICH-04 is to reduce maternal deaths from a baseline of 17.4 maternal deaths per 100,000 live births in 2018, based on the National Vital Statistics System estimate to 15.7 per 100,000

ⁱⁱⁱ HHS Action Plan to Improve Maternal Health in America Objective 3.1 is to “improve the quality of and access to postpartum care, especially mental health and substance use services.

^{iv} Connecticut Department of Public Health registration reports were used to determine the count of live births.

^v Classification was based on causes of death listed on the death certificate. For all but two deaths that occurred between 2015 and 2019, CT MMRC agreed with the cause of death listed on the death certificate. In two instances, CT MMRC assigned a different cause of death.

^{vi} Per CDC’s Committee Decisions Form, system is defined as “interacting entities that support services before, during, or after a pregnancy - ranges from healthcare systems and payors to public services and programs.”

^{vii} In two cases, the cause of death was categorized as accidental overdose but there was not enough information to determine whether or not the decedent had a substance use disorder. Yet, CT MMRC determined that substance use disorder contributed to the death in both instances. This apparent contradiction reflects a tendency to conflate substance use disorder with substance use.

^{viii} In December 2020, CT DPH SAR staff members updated their matching algorithm to account for cases with missing data on the birth/death certificate number field and are able to cast a wider net in their search of pregnancy-associated deaths than they were able to do in the past.

^{ix} Starting with deaths that occurred in 2019, the ICD-10 code A34 (obstetrical tetanus) was added to the search. Additionally, death records from 2005 onward were searched for the code A34 and no additional deaths were identified.

^x That CT MMRC has identified, on occasion, a different underlying cause of death from the one listed on the death certificate should not come as a surprise. This occurs because the Committee has more information about decedents' lives and deaths than is typically available to death certifiers at the time of death. For all deaths that occurred between 2015 and 2017, the Committee agreed with the cause of death listed on the death certificate. For deaths that occurred in 2018, there were a few instances in which the Committee disagreed with the cause of death listed on the death certificate and identified a different cause of death.

^{xi} CT MMR program staff search for newspaper articles and other publicly available documents to assist with preparing case narratives. For the purpose of the qualitative analysis presented in this report, the evaluators independently searched for publicly available materials in order to obtain contextual information and details that were not included in the case narratives.

