

Estimating the Costs of Untreated Perinatal Mood and Anxiety Disorders in Vermont

Key takeaways



PMADs are among the most common complications of pregnancy and childbirth.

From 2018 to 2020, one in four pregnant or postpartum people in Vermont experienced PMADs.



Untreated PMADs account for an estimated \$48 million in societal costs in Vermont for the average annual birth cohort from conception through five years postpartum.

Individuals and their families, insurers, and the state bear these costs.



Nationally, half of birthing parents with a PMAD do not get the treatment they need.

Untreated PMADs have consequences for both the birthing parent and child.

Introduction

Perinatal mood and anxiety disorders (PMADs) are mental health conditions that develop during pregnancy and the year after delivery. The prevalence of PMADs has risen over the past two decades, with cases of depressive disorders at delivery rising over sixfold in Vermont between 2001 and 2014.¹ More recently, in 2018 through 2020, PMADs affected more than 25 percent of pregnant and postpartum people in Vermont.²

Because PMADs often go undiagnosed and untreated despite effective screening and treatment tools, these statistics likely underestimate the true number of people affected. Nationally, half of all perinatal individuals with a diagnosis of depression do not receive the treatment they need.³ Untreated PMADs can cause multigenerational harm to both birthing parents and their children, leading to a heavy financial burden for the state.

Vermont's Screening, Treatment, and Access for Mothers and Perinatal Partners (STAMPP) program, a five-year cooperative agreement with the Health Resources and

Box 1. Key terms

We use the following terms to describe pregnant and postpartum Vermonters and their children, recognizing that not all people who get pregnant and give birth identify as women:

- **Birthing parents.** Those who are pregnant and those who give birth to a child.
- **Pregnancy outcomes.** Adverse health conditions arising from pregnancy and delivery.
- **Birthing parent-child pairs.** Those who give birth and their children. ▲

Services Administration, seeks to enhance the system of care for Vermont's perinatal population. The program increases the capacity of medical providers, mental health clinicians, and social service partners to provide wellness and prevention resources and to screen, treat, and refer those in need to accessible services. The program is designed to complement broader approaches to addressing perinatal, infant, and child health in Vermont. As Vermont works to sustain STAMPP activities after the five-year grant period

ends, readily available economic data can help the state prioritize and allocate resources.

This brief presents the results of a mathematical model that quantifies the monetary costs of untreated PMADs in Vermont. It provides data and insights that can inform Vermont's continued efforts to address perinatal mental health and wellness.

Conceptual Model and Approach

To construct the model, we compiled the most recent peer-reviewed literature and secondary data sources to quantify the societal costs of not treating PMADs in Vermont. We collected data on the prevalence of PMADs, the remission rates for PMADs, the incidence of outcomes linked to untreated PMADs, and the medical and nonmedical costs of each outcome. The Vermont Department of Health provided data on the number of births, prevalence of PMADs, and prevalence of other key conditions in Vermont from 2018 to 2020. Averaging the data over several years enabled us to include data from before and during the COVID-19 pandemic to even out any large changes in the incidence of PMADs and record keeping during that period. Notably, evidence suggests a national increase in depressive symptoms among birthing parents in 2020.⁴

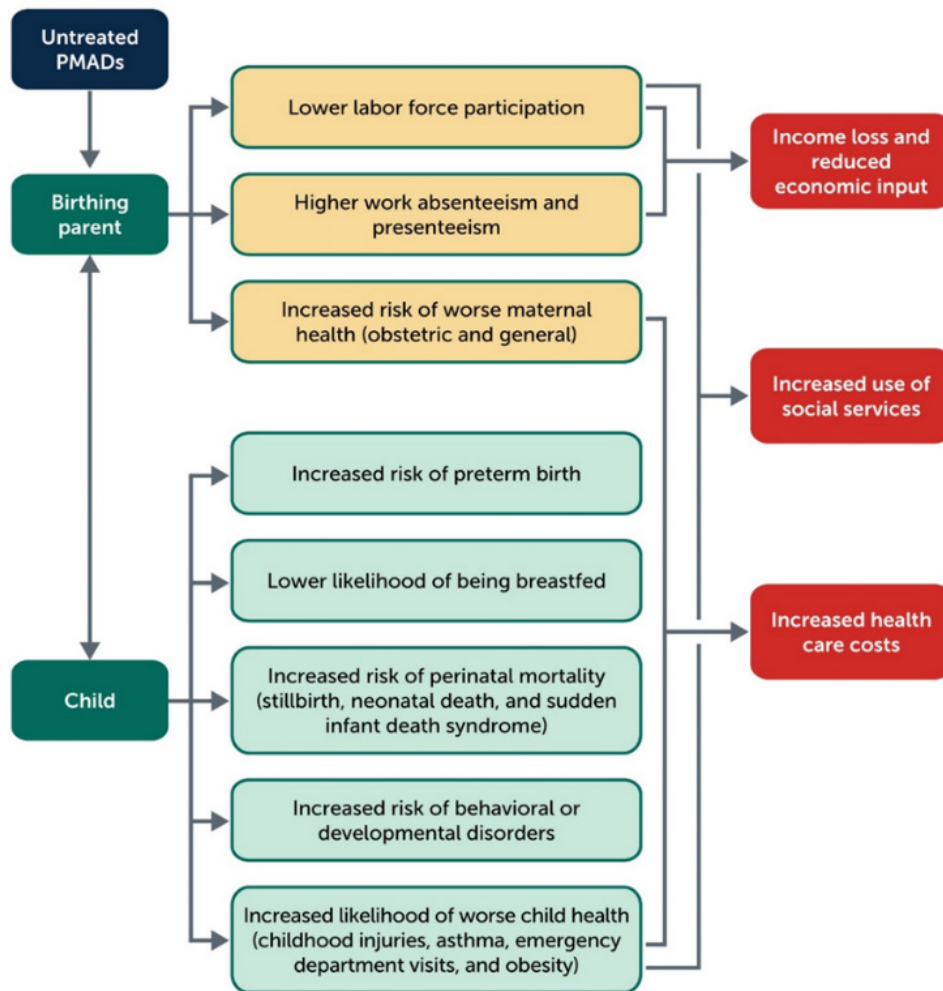
With this information, we created cost estimates for all Vermont births from 2018 to 2020, following the birthing parent from pregnancy through five years postdelivery. We focused on this six-year period to estimate the costs of more immediate outcomes of untreated PMADs, recognizing that costs can continue to incur well into the birthing parent's and child's lifetime.

Box 2. Health disparities by race and ethnicity in Vermont

Due to the large non-Hispanic White population in Vermont, we could not stratify the cost of untreated PMADs by race and ethnicity for this model. However, national research has identified inequities in the prevalence of PMADs and incidence of subsequent outcomes for the Black, Indigenous, and People of Color (BIPOC) population.⁴⁰ PMADs are also screened for and diagnosed less frequently among Hispanic and non-Hispanic Black people than among non-Hispanic White people, exacerbating disparities in treatment along with the measurement of the true cost of PMADs by race and ethnicity.⁴¹ ▲

Figure 1 shows our conceptual framework of how untreated PMADs affect parental and child outcomes, resulting in increased costs to society. Untreated PMADs are linked to an increased likelihood of absenteeism, presenteeism (or lost productivity at work), and unemployment, which can add to the existing challenges of declining workforce participation in the state.⁵⁻⁹ Compared with birthing parents who do not have PMADs, those who do also have an increased risk of preeclampsia, delivery via cesarean section, and longer peripartum hospital stays, which contribute to morbidity and mortality during and after pregnancy.¹⁰⁻¹⁸ Children born to parents with PMADs have a higher risk of preterm birth, lower likelihood of being breastfed, increased risk of perinatal mortality, increased risk of behavioral or developmental disorders, and other poor health outcomes.¹⁹⁻³⁸ Although adverse pregnancy and birth outcomes can contribute to the development of PMADs, which can add to societal costs, our model estimates the costs of downstream outcomes only.³⁹

Figure 1. Conceptual model



As the framework shows, our model categorizes the societal costs of untreated PMADs into three primary domains: (1) parental productivity loss; (2) greater use of public sector services, including the Supplemental Nutrition Assistance Program (SNAP) and Medicaid; and (3) higher health care costs for the birthing parent and child.

Key Findings

We estimated that the prevalence of PMADs among all Vermont birthing parents during pregnancy through one year postpartum is 25.2 percent.² Applying this prevalence estimate to the impact estimates, cost estimates, and remission rates we found in the literature and secondary data sources, we estimated that the total societal cost of untreated PMADs in Vermont is \$48 million for an annual birth cohort from conception to five years postpartum (Table 1). This amounts to almost \$36,000 in excess societal costs per birthing parent with an untreated PMAD and their child,

which is comparable to the national average of about \$35,500, adjusted to 2021 dollars (Figure 2).⁴²

For Vermont, about 56 percent of the societal costs can be attributed to pregnancy outcomes, with the largest costs stemming from productivity loss (\$12.5 million) and non-obstetric health expenditures (\$9.4 million). Productivity loss includes unemployment, missed work days, and reduced productivity while at work, whereas non-obstetric health expenditures include insurer and patient spending on physicians, hospital and outpatient care, medications, and other direct medical services.^{5, 8} Forty-four percent of the costs are related to child outcomes, with the largest costs stemming from preterm births (\$13.1 million) and child behavioral or developmental disorders (\$6.1 million) (Figure 3). Over half of the societal costs occur between pregnancy and the child’s first birthday and are linked to pregnancy and birth complications, such as preterm birth, as well as other obstetric health expenditures.

PMADs remain among the most expensive conditions from the time of pregnancy through five years postdelivery. Examining only medical costs (excluding labor force and nonmedical social services costs), PMADs cost over \$22,000 per birthing parent-child pair from conception to

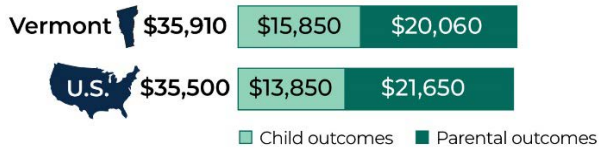
five years postpartum. In comparison, other perinatal conditions, such as gestational diabetes, cost up to \$3,300 per birthing parent-child pair.⁴³

Table 1. Estimates of impacts and societal costs of PMADs for the average annual birth cohort in Vermont, from conception through five years postpartum, 2018–2020

Outcome	Societal costs	
Total societal costs		\$48,017,200
Pregnancy outcomes: Compared with birthing parents without PMADs, those with PMADs		
Cesarean delivery	Are 1.2 times more likely to deliver via cesarean delivery	\$1,364,700
Health expenditures (non-obstetric)	Have an increased health expenditure of \$1,795 for insurers and \$354 in individual out-of-pocket costs	\$9,352,800
Peripartum stay	Have peripartum stays that are 3 days longer on average	\$1,332,800
Preeclampsia	Are 1.9 times more likely to develop preeclampsia	\$1,593,200
Productivity losses	Are 30% more likely to be unemployed, and have increased absenteeism and presenteeism	\$12,545,200
Social service use	Are 0.25% more likely to be enrolled in Medicaid, 0.23% more likely to be enrolled in SNAP, 0.20% more likely to be enrolled in TANF, and 0.175% more likely to be enrolled in WIC	\$635,800
	Total costs for cohort of birthing parents	\$26,824,500
Child outcomes: Compared with the children of birthing parents without PMADs, children of those with PMADs		
Asthma	Are 1.9 times more likely to develop asthma	\$527,300
Behavioral or developmental disorders	Are 1.5 times more likely to develop a behavioral or developmental disorder	\$6,065,300
Childhood obesity	Are 1.4 times more likely to have obesity	\$84,700
Emergency department visits	Are 1.6 times more likely to have an emergency department visit	\$619,400
Hospitalizations for injury	Are 1.9 times more likely to have an injury resulting in a hospitalization	\$181,200
Neonatal death	Are 3.1 times more likely to die during the neonatal period	\$253,800
Preterm birth	Are 2.4 times more likely to have preterm birth	\$13,073,000
SIDS	Are 4.1 times more likely to have SIDS	\$50,800
Stillbirth	Are 2 times more likely to be stillborn	\$54,800
Suboptimal breastfeeding	Are 10% less likely to be exclusively breastfed at 3 months	\$282,400
	Total costs for cohort of children	\$21,192,700

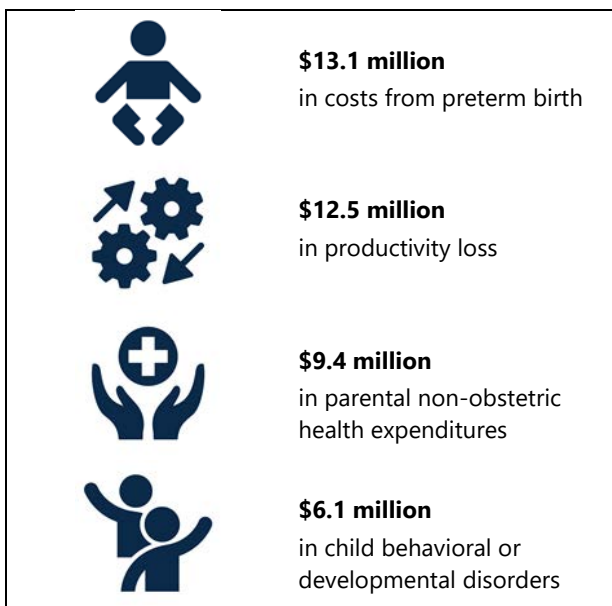
Notes: We use gender-neutral language for pregnancy-related outcomes, although many data sources use other language, such as “women ages 18–44.” PMADs = perinatal mood and anxiety disorders; SIDS = sudden infant death syndrome; SNAP = Supplemental Nutrition Assistance Program; TANF = Temporary Assistance for Needy Families; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Figure 2. Average societal cost per birthing parent-child pair with a PMAD, from conception through five years postpartum, in Vermont



Source: Mathematica calculated the Vermont estimates for this study. Mathematica previously calculated the U.S. estimates; see <https://www.mathematica.org/publications/societal-costs-of-untreated-perinatal-mood-and-anxiety-disorders-in-the-united-states>.

Figure 3. Top parental and child costs associated with PMADs, from conception to age 5



Source: Mathematica calculated the top parental and child cost estimates for this study.

Conclusion

The societal costs of untreated PMADs are substantial for Vermont: \$48 million, or \$35,910 per birthing parent-child pair, for annual births through five years postpartum. Our estimates for Vermont are comparable to the national estimates, which are \$35,500 per birthing parent-child pair, but lower than those of three other states that expanded Medicaid and extended postpartum coverage: California

(\$38,600), Colorado (\$38,500), and Washington State (\$38,100).^{42, 44-46} This suggests that a combination of factors, such as the effect of health care access and quality on the incidence of subsequent outcomes, as well as state policies affecting social determinants of health, are likely driving costs.

Compared with the parameters used to calculate the national estimate, Vermont has a higher prevalence of PMADs (25.2 percent versus 11.5 percent).⁴² The Centers for Disease Control and Prevention found that 90 percent of birthing parents in Vermont were asked about depressive symptoms during a prenatal visit, compared with the national average of 79 percent, contributing to a higher baseline prevalence of diagnosed PMADs in Vermont.⁴⁷

Pregnancy outcomes make up 56 percent of the total costs, and child outcomes comprise the other 44 percent. The outcomes that drive the highest costs in Vermont—preterm birth and productivity loss—are consistent with what we found nationally and for other state-specific models, but the share of costs attributed to child outcomes is greater in Vermont.^{42, 47} Key drivers contributing to this greater share of child costs include a higher rate of child behavioral and developmental disorders in Vermont (11.4 percent versus 6.8 percent nationally) and a lower rate of unemployment among women (3.4 percent versus 4.9 percent nationally).^{48, 49} Furthermore, based on our literature review, we added two new child outcomes (neonatal death and stillbirth) to the Vermont estimates and removed an outcome that resulted in cost savings (reduced well-child visits), which contributed to a higher share of child costs in the Vermont model.

Promoting wellness and supporting the mental health of pregnant and postpartum people can improve health outcomes for them and their children, while reducing the economic burden of PMADs on individuals, families, employers, and the state. Vermont will continue this economic analysis by exploring the impact of expanding the Perinatal Psychiatric Consultation Service, which provides consultation, education, and assistance to primary care providers in treating PMADs, including prescribing and managing psychotropic medication.

Appendix

Vermont's STAMPP program

The Family and Child Health Division at the Vermont Department of Health manages the Screening, Treatment, and Access for Mothers and Perinatal Partners (STAMPP) program, funded by a five-year cooperative grant from the Health Resources and Services Administration. The grant supports activities such as:

- Cross-discipline statewide and local trainings for providers on perinatal mental health and well-being
 - The [Vermont Child Health Improvement Program's](#) continuous quality improvement efforts focusing on screening for perinatal depression, anxiety, and substance use disorders as well as referral and linkage to community resources among primary care practices
 - Expanding [Help Me Grow Vermont](#) to include a resource for referrals to perinatal mental health clinicians and additional national, state, and local perinatal supports
 - Community-led pilot projects focusing on evidence-based, culturally responsive, and respectful programming, support groups, community coalitions, doula services, and training led by community mental health agencies across the state
 - Increased capacity for data collection and evaluation
 - Support for the Perinatal Psychiatric Consultation Service, including referral workflows, data and evaluation assistance, sustainability planning, expansion, and collaboration
 - A communications and branding campaign to increase awareness of PMADs and to connect providers and birthing parents and their families to perinatal mental health and well-being resources, supports, and services in Vermont ▲
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Model Methods

Our model focused on Vermont-specific pregnancy and child health outcomes linked to perinatal mental health conditions. We started with the articles from our prior studies, Luca et al. (2020) and Margiotta et al. (2022), which supported relationships between PMADs and subsequent outcomes.^{42, 47} To update our data from prior analyses, we conducted an additional literature review of studies published between 2019 and 2022. After our review, which included rigorous selection criteria that controlled for confounding factors, we selected relevant new articles to add to those used in our prior study, which provide evidence for six pregnancy outcomes and 10 child outcomes.

We used a cost-of-illness methodology to synthesize the estimates from the literature review with additional secondary data sources to inform the model's inputs. We generated three input types for the model: (1) impact estimates from our literature review, which measure the incremental effects of having a PMAD; (2) the prevalence of PMADs in Vermont; and (3) the associated costs and baseline rates of each outcome affected by exposure to PMADs, such as preterm birth. The Vermont Department of Health provided baseline rates for most outcomes, and we calculated the Vermont or national rates using publicly available data sources for the remainder.

Drawing on data from Vermont's Pregnancy Risk Assessment Monitoring System (PRAMS), we estimated the average annual number of birthing parents with PMADs in Vermont between 2018 and 2020. Using three years of data enabled us to incorporate more recent data while smoothing some of the effects of COVID-19 on diagnosis rates. We then used the impact estimates and baseline average annual incidence of each outcome between 2018 and 2020 (see table A.1) to calculate the incremental number of birthing parents or children who would experience each outcome directly because of untreated PMADs. For example, for our child injury impact estimate, we measured the incremental risk of injury to the child of a birthing parent with an untreated PMAD relative to a birthing parent without a PMAD. Adding this estimate to the baseline rate of child injury in the Vermont population yields an approximate likelihood of an injury for children of birthing parents with an untreated PMAD.

To calculate the aggregate excess costs of outcomes associated with PMADs, we multiplied the individual incremental risk of each outcome by the expected number of birthing parents in Vermont with PMADs. We then multiplied the product by the incremental unit cost of the outcome, inflated to 2021 dollars. We made assumptions based on the literature about whether each outcome would incur one-time or ongoing costs and then extrapolated the costs to the six-year period. For example, a cesarean section would incur a one-time medical cost, whereas the cost of child developmental disorders would continue through the child's fifth birthday and beyond. We also applied an average rate of birthing parents who do not experience remission by the end of the first year postpartum to relevant outcomes in Years 1 to 5 to measure the cost of untreated PMADs.⁵⁰ We then calculated the societal costs of untreated PMADs by adding the costs across all outcomes and years, with a social discount rate of 3 percent.⁵¹

Limitations

Restricted time frame. We designed this model to focus on a six-year period (pregnancy through five years postdelivery) so that stakeholders could understand the immediate impacts of untreated PMADs. We recognize, however, that PMADs can have long-term effects on the birthing parent and child, and thus our estimates might represent only a fraction of the lifetime costs.

Impact of COVID-19. The COVID-19 pandemic caused major changes to health care use and the incidence of mental health conditions starting in 2020. The most recent data publicly available for most outcomes were from 2020, but prevalence and incidence rates for that year might not reflect a typical year in Vermont. We decided to calculate the weighted average of 2018 to 2020 rates to (1) incorporate the most recent available year of data and (2) smooth rates across more typical years. Our final estimates represent the average societal costs of an annual birth cohort from 2018 to 2020, projected five years postpartum.

Cost of treating PMADs. This model does not explore the economic case for intervention or the cost of treating PMADs. Therefore, the model does not incorporate various treatment options, nor does it differentiate between inadequate treatment and no treatment for PMADs.

Causality. Our model does not directly address the causality of PMADs. We recognize that many factors can affect or have associations with PMADs before, during, and after pregnancy. When constructing our model using prevalence estimates of PMADs and outcomes, we did not assess the timing of PMADs relative to perinatal events.

Limited primary data analyses. The model primarily used inputs from publicly available secondary data and existing peer-reviewed literature. Although the model includes some original analyses (conducted by the state) of the prevalence of PMAD outcomes in Vermont, we did not analyze any additional primary data for the cost and impact estimates. Additional primary data analyses could provide a more complete and accurate understanding of the true cost of untreated PMADs in Vermont.

Other caregivers. Although we recognize that caregivers besides birthing parents (such as nonbirthing parents, nonrelated caregivers, siblings, foster parents, and adoptive parents) can have mood and anxiety disorders or be affected by them, we modeled the burden of PMADs on society among birthing parents only. We focused on the outcomes and costs of the birthing parent-child pairs in the model.

Differential effects between racial/ethnic groups. Through our literature review, we found differential effects of PMADs and subsequent outcomes between different racial and ethnic groups on a national level.⁵² For example, nationally, Black non-Hispanic birthing parents have higher rates of PMADs during or after pregnancy than White non-Hispanic birthing parents, which corresponds to a higher incidence of outcomes such as preterm birth and their associated costs. Furthermore, perinatal mental health conditions are screened for and diagnosed at a higher rate among White birthing parents than among Black, Indigenous, and People of Color (BIPOC) birthing parents, contributing to even greater disparities in measuring the true cost burden among communities of color.⁴¹ The small size of the BIPOC population in Vermont made it impossible for us to adequately measure the cost of untreated PMADs by racial or ethnic group. Future researchers might wish to conduct additional primary data analyses to examine these differences.

Table A.1. Baseline incidence rates

Outcome	Source	Population	Timing of cost	Type of cost
Birthing person				
Cesarean delivery	Vermont Department of Health: Vital Statistics ²	Vermont birthing parents	One-time	Medical
Health expenditures	Peer-reviewed literature ⁵	U.S. birthing parents	Ongoing	Medical
Peripartum stay	Average length of stay based on policy ⁵³	U.S. birthing parents	One-time	Medical
Preeclampsia	Green Mountain Care Board: Vermont Uniform Hospital Discharge Data Set ⁵⁴	Vermont birthing parents	One-time	Medical
Productivity loss	U.S. Bureau of Labor Statistics ⁵⁵	Vermont birthing parents	Ongoing	Nonmedical
Social service use	U.S. Census Bureau; U.S. Food and Drug Administration; U.S. Department of Agriculture; CDC ^{56–60}	Vermont birthing parents	Ongoing	Nonmedical
Child				
Asthma	Vermont Department of Health: National Survey of Children's Health ⁶¹	Vermont children ages 0–5	Ongoing	Medical and nonmedical
Behavioral or developmental disorders	Vermont Department of Health: National Survey of Children's Health ⁶¹	Vermont children ages 3–5	Ongoing	Nonmedical
Childhood obesity	Vermont Department of Health: Division of Nutrition, Physical Activity, and Obesity WIC data ⁶²	Vermont children ages 2–4	Ongoing	Medical
Emergency department visits	Green Mountain Care Board: Vermont Uniform Hospital Discharge Data Set ⁵⁴	Vermont children	Ongoing	Medical
Injury	Vermont Department of Health: Healthcare Cost and Utilization Project State Inpatient Database ⁶³	Vermont children ages 0–9	Ongoing	Medical and nonmedical
Neonatal death	CDC ⁶⁴	U.S. pregnancies	One-time	Nonmedical
Preterm birth	Vermont Department of Health: Vital Statistics ⁶⁵	Vermont live births	One-time	Medical
SIDS	Vermont Department of Health: CDC WONDER and internal sources ⁶⁶	Vermont live births	One-time	Nonmedical
Stillbirth	CDC ⁶⁷	Vermont live births	One-time	Medical
Suboptimal breastfeeding	Vermont Department of Health: National Immunization Survey ^{68–70}	Vermont newborns	One-time	Nonmedical

CDC = Centers for Disease Control and Prevention; SIDS = sudden infant death syndrome; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

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The analyses, conclusions, and recommendations drawn from the Vermont Uniform Hospital Discharge Data Set are solely those of the authorized user or the principal investigator and are not necessarily those of the Green Mountain Care Board.

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