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Davidson County Child Death Review

Data Report 2021



Metro Public Health Dept
Nashville/Davidson County

Protecting, Improving, and Sustaining Health

Davidson County Child Death Review Data Report, 2021

Lead Author: Brook McKelvey, MPH, MA
Division of Epidemiology
Metro Public Health Department of Nashville/Davidson County, TN

Leaders of the Child Death Review Team

Erin Carney, MD, Team Chair
Medical Examiner
Metropolitan Nashville/Davidson County, TN

Emily Dennison, MD, Team Chair
Medical Examiner
Metropolitan Nashville/Davidson County, TN

Gill Wright III, MD, Team Chair
Director of
Metro Public Health Department of Nashville/Davidson County, TN

Brook McKelvey, MPH, MA, Team Coordinator
Division of Epidemiology
Metro Public Health Department of Nashville/Davidson County, TN

Autumn Ganis, BS, Assistant Team Coordinator
Division of Epidemiology
Metro Public Health Department of Nashville/Davidson County, TN

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Preface

Mission

The mission of the Davidson County Child Death Review Team (CDRT) is to provide a better understanding of how and why children die in order to find ways to help reduce the number of preventable child deaths. This is accomplished through comprehensive and multidisciplinary reviews of the circumstances surrounding each death.

Background

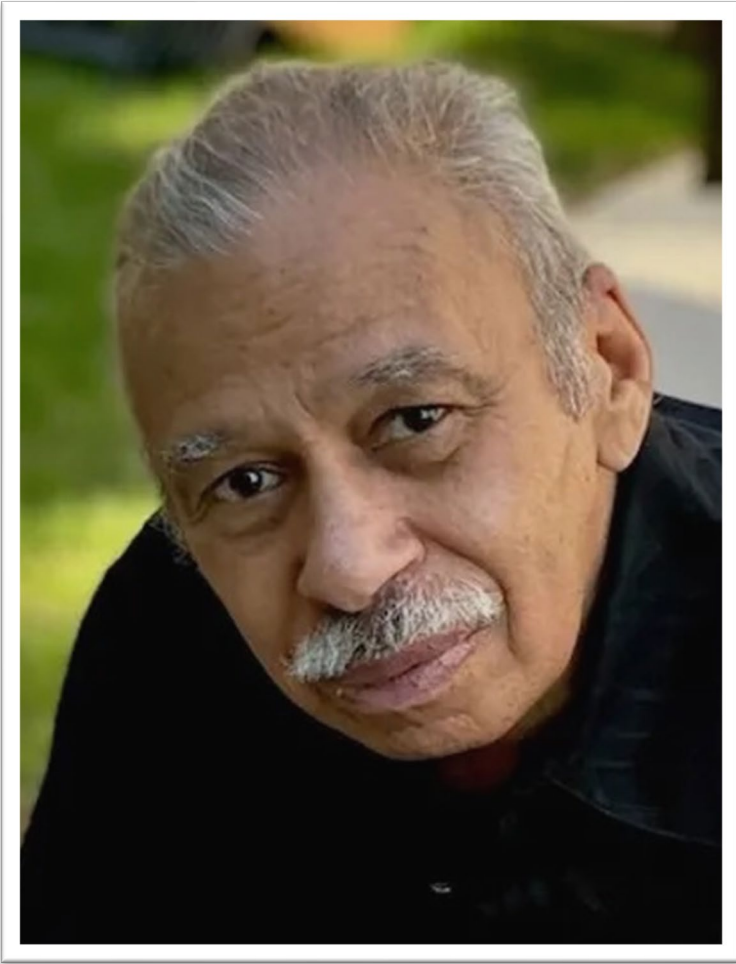
The CDRT is empowered by state statute (T.C.A. 68-42-101) and mayoral executive order to conduct reviews of deaths to resident children under the age of 18 years in order to achieve the following goals:

1. Ensure an accurate inventory of child fatalities by demographics, geographic locations, causes, and manners
2. Support adequate child death investigations
3. Enable multi-agency collaboration, cooperation, and communication at the state and local levels to address child fatalities
4. Analyze patterns and trends in total and cause-specific child fatalities, with greater emphasis on preventable deaths related to abuse and neglect, unsafe sleeping environments, and inadequate medical care or public health services
5. Enhance community awareness of the epidemiology of childhood mortality, and public understanding of why and how children die
6. Develop recommendations and community-based prevention initiatives to reduce child fatalities among Davidson County residents

About This Report

This report first summarizes the key issues, recommendations, and actions resulting from the CDRT's detailed review of each child death occurring in Davidson County during 2021. The report then presents quantitative results from the epidemiological analysis of child fatalities with an emphasis on describing the cause and manner of death, preventability, context, and modifiable risk factors associated with the deaths.

In Memoriam



The Child Death Review Team of Nashville and Davidson County (CDRT) mourned the loss of a devoted and dear colleague in April 2022. Dr. Michael Hudson Meadors, Sr., practiced obstetrics and gynecology in Nashville for more than 40 years. He delivered more than 15,000 babies, and his personal connection with patients allowed him to share in their joy of new life, and their grief when that life was cut short.

It was the latter that led him to join the CDRT in July 2000. Dr. Meadors brought his obstetrical and gynecological expertise to the review of the deaths of Nashville's children. His participation was instrumental in the development and implementation of systems changes designed to prevent child death and parental grief. Review of these deaths was not something he

enjoyed, but his calling as a physician brought him back each month determined to contribute whatever he could to prevent future suffering.

The CDRT remembers him as a knowledgeable, caring, and matter-of-fact colleague. Dr. Meadors spoke his mind and was fearless in addressing difficult or uncomfortable issues, and his insight was appreciated at the table. He also brought a positive energy to the meetings, and a well-placed comment from him was often enough to lighten the mood and encourage the team. Dr. Meadors knew he did not have all the answers but had faith that the interaction of the group would reveal the path forward.

We are grateful for Dr. Meadors' years of service. His contributions will not be forgotten, and the CDRT reaffirms our dedication to the mission: preventing childhood mortality by identifying service gaps and making recommendations for policy, infrastructure, and service changes.

Findings, Actions, and Recommendations Resulting from CDRT Reviews

Each year, based on the findings of child death reviews, the CDRT makes recommendations for policy, infrastructure, and service changes in an effort to prevent future childhood mortality. The Tennessee Department of Health (TDH) State Child Fatality Review Team consolidates recommendations from local fatality review teams and uses them to guide legislative, programmatic, and policy agendas for Tennessee.

At the local level, the Davidson County CDRT facilitates the implementation of recommendations through direct interaction with the agencies and organizations involved, or through contacts and partnerships with community groups. Findings, recommendations, and actions based on 2021 cases are presented in Table 1 below.

Table 1. Findings, Actions, and Recommendations, Davidson County CDRT, 2021

Findings	Recommendation/Action
<ul style="list-style-type: none"> Service Provision and Availability: Reviews led the CDRT to express concern about the limited nature of the language in the Department of Children’s Services (DCS) policy regarding medical neglect, specifically around parents’ or guardians’ failure to obtain therapy for children after a traumatic event. The effect of childhood trauma and ACES on the development of young people has been widely documented and the State of Tennessee has pushed systems to implement trauma-focused policies, protocols, and programs. 	<ul style="list-style-type: none"> The CDRT submitted the following recommendation: Current DCS policy stipulates that medical neglect does not occur until a parent or guardian fails to provide or follow-through with necessary medical treatment. Unless mental health support following trauma is deemed necessary, a parent or guardian cannot be held accountable for not obtaining these services for their children. Yet, case reviews repeatedly reveal that the long-term impact of trauma among youth can result in risk-taking behaviors that could result in untimely death. These deaths could have been prevented if the children were provided the opportunity to process trauma early and in an appropriate manner. Given that research indicates multiple possible negative outcomes for children experiencing trauma, and the results of case review, the CDRT recommends that DCS policy be modified to reflect the obligation of parents or guardians to seek and obtain appropriate mental health services for children in their care after a traumatic event. The CDRT views this recommendation as an important

Findings	Recommendation/Action
<ul style="list-style-type: none"> • Injury Prevention: The CDRT noted the importance of water safety education for drowning prevention, and requested an inventory of available free or low-cost swim classes in the community. 	<p>step in DCS shifting its focus from reactionary response to prevention.</p> <ul style="list-style-type: none"> • Metro Parks (MP) offers low-cost swim lessons at Smith Springs, East Park, Hartman Park, Hadley Park, and Coleman Regional Centers. These are well attended and sometimes have waiting lists. Free lifeguard training is also offered to teens. At least one community center indicated a need for more multicultural and multilingual swimming instructors. Water safety and swimming is not currently taught in any of Metro School (MNPS) physical education classes. In the past, MNPS had a partnership with the YMCA where students were transported to the facility for swimming lessons.
<ul style="list-style-type: none"> • Injury Prevention: Reviews raised concerns about the fentanyl crisis. Given the prevalence of fentanyl in fake prescription pills, the CDRT considered ways to broaden the training and distribution of Narcan to prevent overdose deaths. 	<ul style="list-style-type: none"> • The CDRT recognizes that deaths from fentanyl overdoses are increasing, and that broad distribution, training, and usage of Narcan can help prevent future deaths. Given that the shelf-life of Narcan has increased to 2 years, the CDRT recommends that the Tennessee Hospital Association require that training in the use and distribution of Narcan be coupled with the required CPR certification for medical professionals.
<ul style="list-style-type: none"> • Injury Prevention: Reviews raised questions about safe sleep policies and what training is provided to DCS staff, field workers, and clients. 	<ul style="list-style-type: none"> • DCS has policies for safe sleep education and the delivery of needed safe sleep furniture. Case managers (CM) provide safe sleep education to all members of a household who may serve in a caregiving role, including siblings and other relatives. This education is always presented verbally, but may be supplemented with handouts, media presentations, and active demonstrations. Safe sleep furniture is available 24/7 to all families served by DCS. Furniture is provided as soon as possible, but always within 8 hours of the need being identified. The CM must visually verify the presence of fully set-up safe sleep furniture within 8 hours of the need being identified.

Findings

- **Injury Prevention:** Reviews suggested that the documentation of offered resources for patients arriving at the hospital for a suspected or confirmed overdose may be insufficient.

- **Domestic Violence Prevention:** The CDRT noted that a person seeking an order of protection (OP) at the Metro Office of Family Safety (OFS) or Agape receives support and resources and a conversation about why the person's child may need to be included in the order. Reviews indicated that people seeking orders of protection at night court may not receive those services.

- **Service Provision and Availability:** Reviews indicated that if a death does not fall under Medical Examiner

Recommendation/Action

- The objective of this action item was fact-finding and did not result in a recommendation at this time. Research revealed that hospitals have been operating at max capacity since the start of the COVID-19 pandemic. The main objective when a patient has overdosed is to stabilize and release. Additionally, all hospitals operate differently and there is no reporting standard. ICD-10 codes identify overdoses and specify suspected substances. Referrals are based on hospital-specific protocols, which all tend to be different. Patients are regularly given the REDLine number upon discharge, which is a toll-free information and referral line that provides accurate substance use information to all citizens of TN upon request. Most hospitals are aware that a peer navigator is available to speak to patients, but the time difference between how long they can keep a patient versus how long it takes for a peer navigator to arrive prevents full usage of the service.

- Research revealed that no services are offered to a person seeking an OP at night court. There is safety planning and domestic violence education nearby, but no direct services or supports are provided. Petitioners have the choice on whether to include their children in the OP narrative, and no one is having a conversation with them to help them decide. If a petitioner fails to appear in court and the OP is dropped, no related DCS referrals are made. The abuse allegation or disclosure is called into the child abuse hotline at the time the OP is completed. Given the lack of supports and resources provided at night court, and the possibility of missed DCS referrals, the CDRT formed a small workgroup to consider possible recommendations.

- Given that autopsy can be part of the grieving process for parents, the CDRT formed a joint workgroup with the Fetal and

Findings	Recommendation/Action
<p>jurisdiction and the physician does not request an autopsy, parents who request an autopsy may be financially responsible for the procedure. Pricing is not transparent and rarely communicated to the parent in advance.</p> <ul style="list-style-type: none"> • Policy: Reviews raised concerns that printed hospital discharge instructions at one hospital advised follow-up with a pediatrician within 2 weeks after delivery discharge. 	<p>Infant Mortality Review (FIMR) to investigate autopsy costs, quality of counseling provided to parents about the reason their child died and whether an autopsy would provide additional explanation, and barriers to providers suggesting autopsy to parents.</p> <ul style="list-style-type: none"> • The Team agreed that though the length of post-discharge pediatrician visits for newborns can vary depending on the health of the child and experience of the mother, two weeks is too long. Based on these findings, the hospital director implemented a change to the standard infant discharge instructions to indicate patients should follow-up with the pediatrician within 1 week of discharge.

Report Highlights

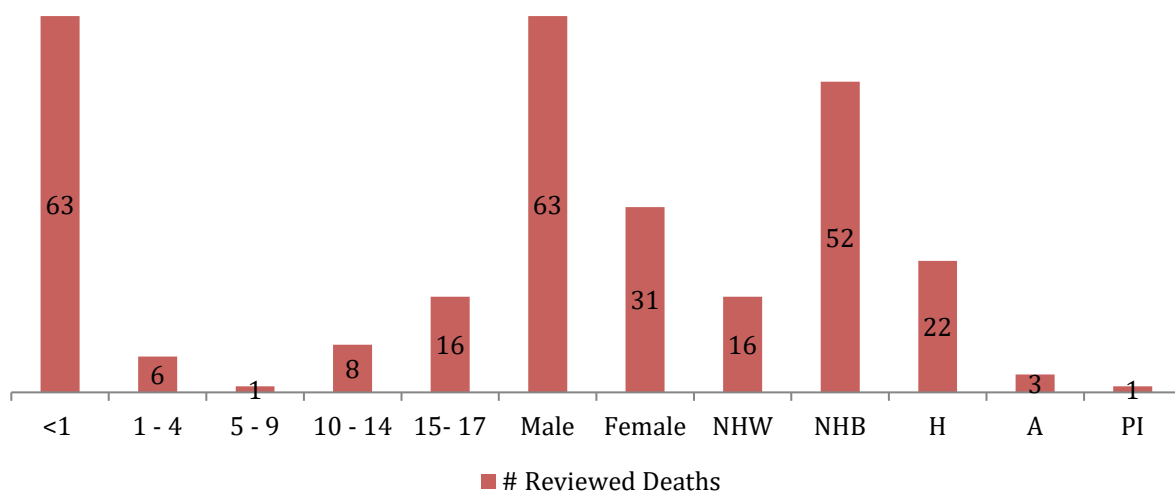
- In 2021, the CDRT reviewed 94 child deaths. Two-thirds of these deaths (63 deaths, 67%) occurred to infants under 1 year of age.
- The mortality rate for children aged 0 to 17 years in Davidson County in 2021 (78.7 deaths per 100,000) was 18% higher than the previous year. This rate remains higher than the rates for Tennessee and the United States.
- The CDRT determined that 48% of the child deaths reviewed in 2021 were preventable. The high proportion of preventable deaths highlights the ongoing need for a thoughtful review of each death to understand the risk factors and circumstances leading to injury and illness or death and identify opportunities for prevention.
- In 2021, the mortality rate for Non-Hispanic Black (NHB) children was 153.5 deaths per 100,000, compared to 39.1 for Non-Hispanic White (NHW) children. NHB children were 3.9 times more likely to die than NHW children. This disparity persisted over the 5-year period from 2017 to 2021.
- In 2021, the NHB infant mortality rate was 15.7 deaths per 1,000 live births, and the NHW infant mortality rate was 3.4. During 2017-2021, NHB infants were, on average, 4.2 times more likely to die than NHW infants. The disparity increased from 3.8 in 2020 to 4.6 in 2021.
- Approximately 30% (19 deaths) of infant deaths reviewed in 2021 were sleep-related, and of those, 84% occurred when infants were placed to sleep in unsafe bedding.
- Eighteen deaths (19%) resulted from unintentional injuries, including suffocation (10 deaths), motor vehicle crashes (4), poisoning (2), drowning (1), and firearms (1).
- There were 14 deaths (15% of total reviewed) related to violence (i.e., homicides and suicides). Most of these deaths occurred to males (12 deaths), children aged 15 to 17 years (11 deaths), and NHB children (11 deaths).
- Approximately a third of the reviewed deaths (29 deaths, 31%) showed some evidence of maltreatment, defined as abuse, neglect, lack of supervision, or negligence. In 82% of these deaths, the child's biological parent or primary caregiver was implicated.

Executive Summary

Overall Child Mortality

The CDRT reviewed 94 deaths that occurred to Davidson County children in 2021. The first year of life appears to be the most vulnerable for Davidson County’s children, accounting for 67% of all deaths under the age of 18 years (Figure 1). Children aged 15-17 years had the next highest percentage of deaths at 17% followed by children aged 10-14 years (9%). Children aged 1-4 years and 5-9 years had the lowest percentage of deaths (6% and 1% respectively). More males (67%) than females (33%) died in 2021.

Figure 1. Number of Reviewed Deaths by Age, Sex, and Race/Ethnicity, Davidson County, TN, 2021



Data Source: MPHD, Child Fatality Review Database System

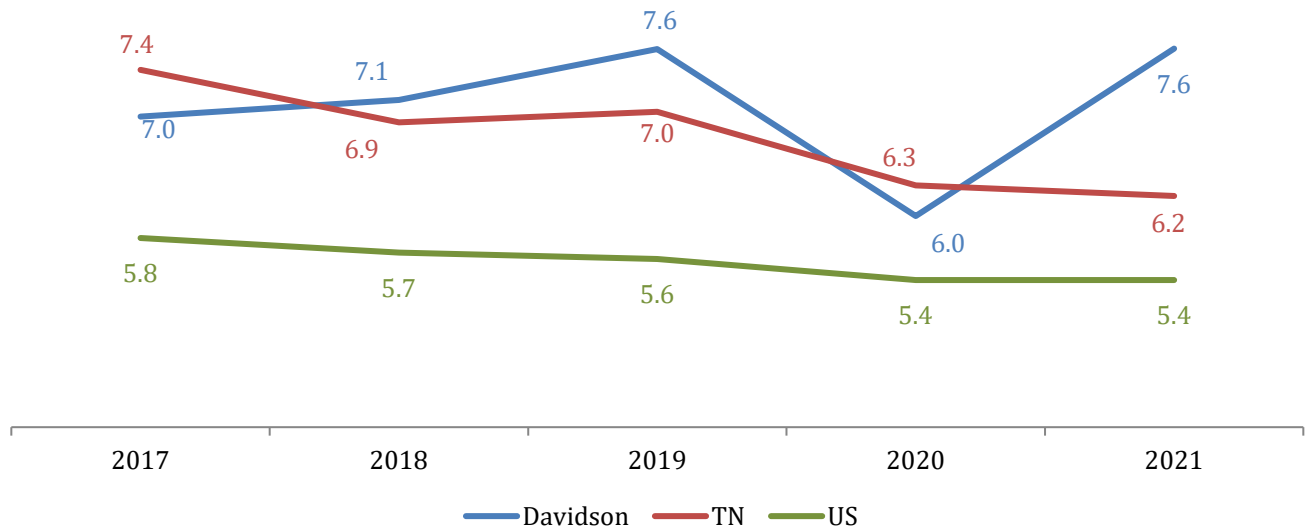
In 2021, similar to previous years, there were racial and ethnic disparities in child fatalities within the county (Figure 1). NHB children represented a disproportionately higher percentage of the total reviewed deaths (55%), followed by Hispanic children (23%) and NHW children (17%).

In 2021, the annual mortality rate for NHB children was 3.9 times higher than for NHW children, up from 2.7 times higher in 2020. Additionally, the NHB mortality rates in 2021 increased from rates in 2017. Between 2017 and 2021, the NHB mortality rate increased from 131.0 to 153.5 per 100,000 population (17% increase). Similarly, the rates for Hispanics increased from 76.8 to 88.6 (15% increase). In contrast, the rate for NHW children decreased from 51.0 to 39.1 (23% decrease).

Infant Mortality

In 2021, the infant mortality rate rose to 2019 levels at 7.6 deaths per 1,000 live births, a 27% increase from 6.0 deaths per 1,000 live births in 2020. The five-year (2017-2021) infant mortality rates in Davidson County are consistently higher than national rates and similar to rates in Tennessee. Since 2019, Tennessee rates consistently decreased in contrast to rates in Davidson County. (Figure 2).

Figure 2. Infant Mortality Rates per 1,000 Live Births, Davidson County, Tennessee, and the US, 2017-2021



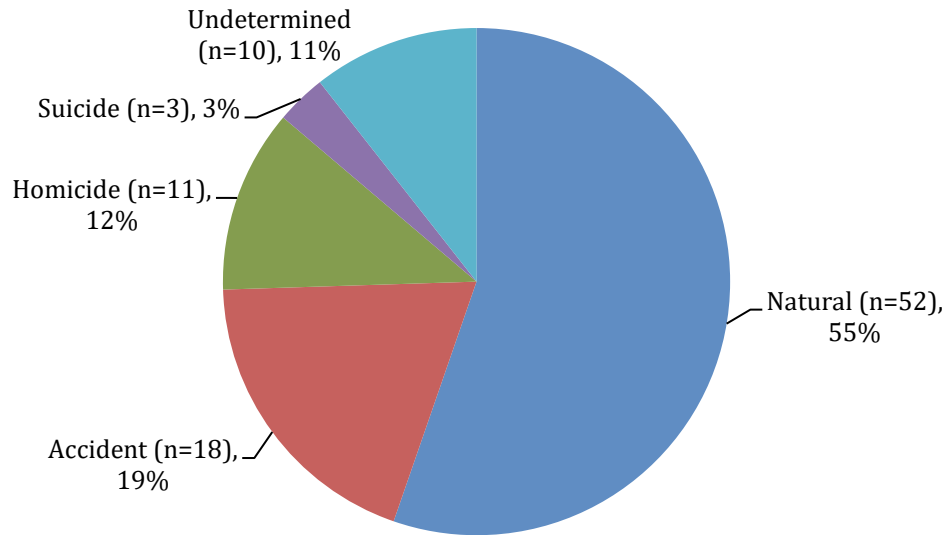
Data Sources: Vital records provided by Tennessee Department of Health; Tennessee and US rates from CDC Wonder.

Between 2017 and 2021, mortality rates among NHB infants increased from 12.7 to 15.7 deaths per 1,000 live births. The rates among NHW infants remained stable at 3.4 deaths per 1,000 live births, and the rates among H infants decreased from 8.4 to 7.5 per 1,000 live births (Figure 8, page 23). The disparity between NHB and NHW infant mortality rates remains troubling; on average, NHB infants died at a rate 4.1 times higher than that of NHW. Additionally, H infants died at a rate 2.1 times that of NHW infants.

Manner of Death

In 2021, most reviewed deaths in Davidson County resulted from natural causes (55%), followed by accidents (19%), homicides (12%), and suicides (3%) (Figure 3). Additionally, 11% were categorized as undetermined because their cause or manner remained unknown after autopsy and death scene investigation.

Figure 3. Percent of Reviewed Deaths by Manner of Death, Davidson County, TN, 2021



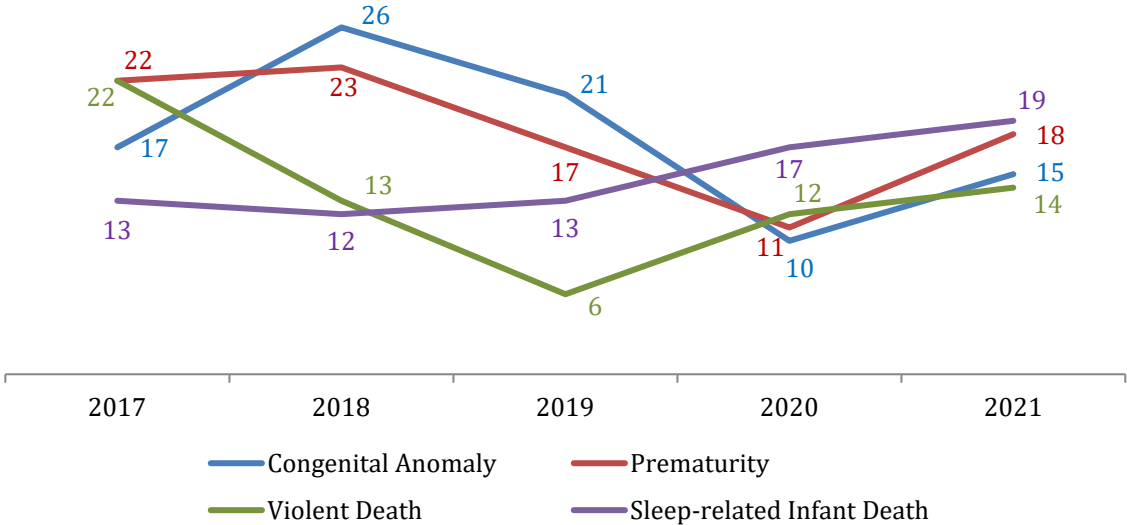
Data Source: MPH, Child Fatality Review Database System

Cause of Death

Among the 52 natural deaths in 2021, the leading causes were prematurity (35%), congenital anomalies (29%), perinatal conditions (10%), and cancer (8%). Among the 18 deaths due to unintentional injury, suffocation was the leading cause (10 deaths), followed by motor vehicle crashes (4 deaths). There were 11 homicides and 3 suicides in 2021. Firearms were the leading mechanism of death for both homicides and suicides (homicide: 11 of 11 deaths; suicide: 2 of 3 deaths).

Figure 4 displays the 5-year trends in the number of infant and child deaths for 4 leading causes of death from 2017 through 2021. The number of deaths in 2021 increased for each leading cause from the previous year. The number of sleep-related infant deaths (SRID) increased 12% (2020: 17 deaths; 2021: 19 deaths) between 2020 and 2021, and 46% over 5 years (2017: 13 deaths). Deaths due to prematurity increased 64% from the number in 2020 (2020: 11 deaths; 2021: 18 deaths), but decreased 18% over the 5 years (2017: 22 deaths). The number of deaths due to congenital anomalies increased 50% from the number in 2020 (2020: 10 deaths; 2021: 15 deaths), and decreased 12% over the 5-year period (2017: 17 deaths). Violent deaths, defined as homicides and suicides together, increased 17% from 12 in 2020 to 14 in 2021, but decreased 36% over the 5 years (2017: 22 deaths).

Figure 4. Number of Reviewed Deaths for Selected Causes, Davidson County, TN, 2017-2021



Data Source: MPHD, Child Fatality Review Database System

Introduction

The Child Death Review process brings together a multidisciplinary team to examine child deaths in the community to understand why children die and focus on prevention efforts that reduce childhood injury, illness, and death. Information on each death is collected from a wide range of agencies and medical providers and carefully reviewed. The process allows for the identification of inefficiencies and gaps in medical care and social support systems, as well as gaining understanding of the broader health issues in the community and modifiable risk factors associated with child deaths.

Data Sources and Data Analyses

This report is based on the 2021 child death review data for Davidson County. Child mortality is defined as the death of a child between 0 and 17 years of age. Infant mortality is defined as a death occurring within the first 12 months of life.

For the current analysis, the death of a child was reviewed if:

- The child resided in Davidson County at the time of death;
- The child was between 0 and 17 years; and
- The death occurred in Tennessee.

In addition, infant deaths were reviewed if they were born on or after 23 weeks gestation or at a weight equal to or greater than 500 grams.

Approximately 84% of all child deaths occurring in Davidson County meet the above criteria and are reviewed. As such, data presented in this report might be slightly different from the data in other published reports based on different data sources (e.g., vital records).

Data from child death reviews were analyzed to provide the frequency distribution of deaths by demographic characteristics (i.e., age, gender, race/ethnicity) and the manner and cause of death.

Mortality rates per 100,000 children and infant mortality rates per 1,000 live births were based on total deaths recorded in the mortality and natality files for Davidson County. The rates for 2021 were compared with rates for the previous 5 years to examine the trend from 2017 through 2021. The geographic distribution of child deaths was also analyzed in conjunction with the Childhood Opportunity Index 2.0 (COI) to determine the intersection between low neighborhood opportunity and high numbers of deaths.

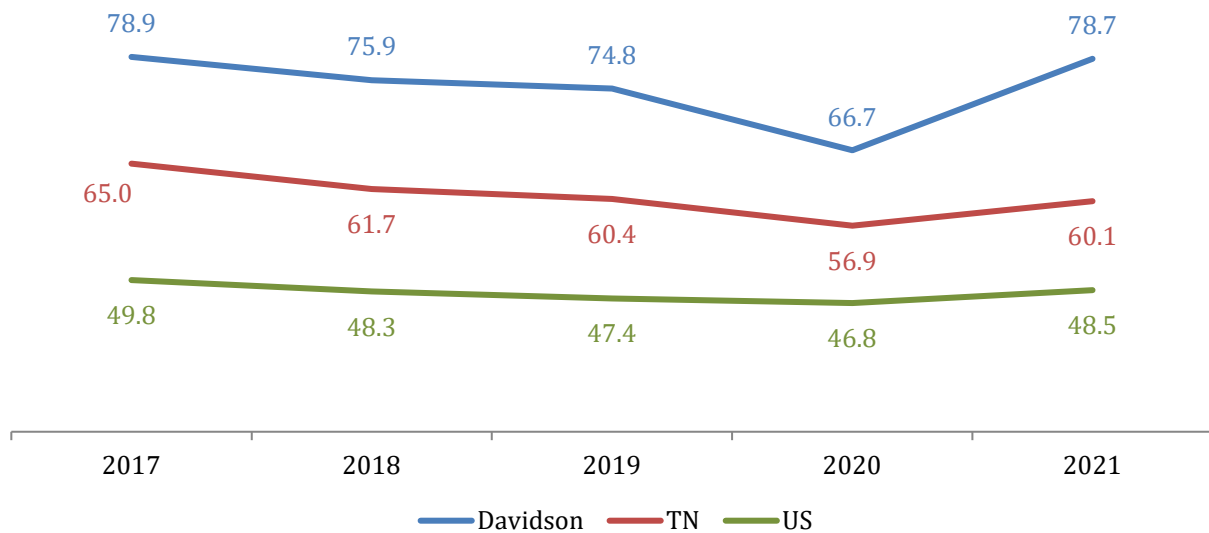
Further details regarding the analysis can be found in the Technical Notes section of this report.

Child Mortality

Overall Mortality

The overall mortality rates for children aged 0 to 17 years in Davidson County were similar in 2021 compared to 2017 with some fluctuations in intervening years (2017: 78.9 deaths per 100,000; 2021: 78.7) (Figure 5). Davidson County mortality rates are consistently higher than rates for Tennessee and the United States. In 2021, the rate for Davidson County was 31% higher than the rate for Tennessee and 62% higher than the national rate.

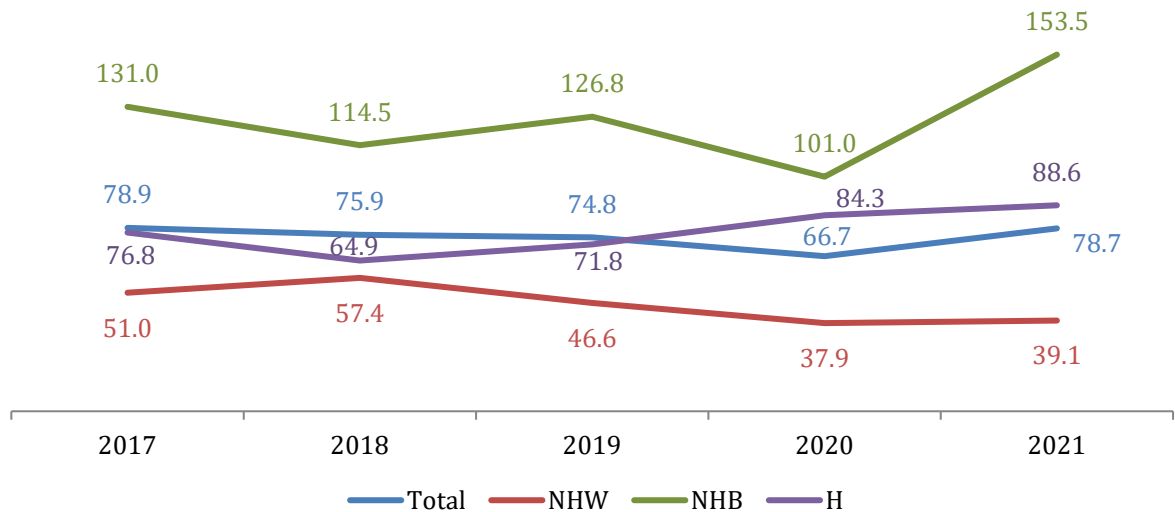
Figure 5. Mortality Rates per 100,000 Children Aged 0-17 Years, Davidson County, Tennessee, and the US, 2017-2021



Data Sources: Vital records provided by Tennessee Department of Health; Population based on American Community Survey 1-year estimates except for 2020, which is based on NCHS bridged-race population estimates; Tennessee and US rates from CDC Wonder.

Racial and ethnic disparities in childhood mortality in Davidson County persisted during 2017-2021 (Figure 6), with NHB children dying at a rate that was, on average, 2.8 times higher than the rate of NHW children. Mortality rates for NHB children increased 17% (131.0 to 153.5 per 100,000) between 2017 and 2021 while the rate for NHW children decreased 23% (51.0 to 39.1 per 100,000). Hispanic child mortality rates increased 15% for the same period (76.8 to 88.6 per 100,000).

Figure 6. Mortality Rates per 100,000 Children Aged 0-17 Years by Race/Ethnicity, Davidson County, TN, 2017-2021



Data Sources: Vital records provided by Tennessee Department of Health; Population based on American Community Survey 1-year estimates except for 2020, which is based on NCHS bridged-race population estimates.

Manner of Death

Manner of death is a way of categorizing deaths based on the circumstances under which a death occurred. This is assigned by either the physician certifying the death or the medical examiner conducting the autopsy. Each death is classified as one of the following manners: Natural, Accident, Homicide, Suicide, or Undetermined.

Of the 94 deaths reviewed in 2021, 52 (55%) were classified as natural, 18 (19%) as accidental, 11 (12%) as homicide, and 3 (3%) as suicide. Manner was undetermined in an additional 10 (11%) cases. When data were stratified by sex, and race/ethnicity, natural causes was the leading manner of death in every subgroup. Differences were noted when stratifying the data by age. Natural causes was the leading manner of death among infants (45 deaths), and tied with accidental deaths for children aged 1-4 years (2 deaths) and 10-14 years (3 deaths). Homicide was the leading manner among teens aged 15-17 years (9 deaths) (Table 2).

Table 2. Number of Reviewed Deaths by Manner of Death among Children Aged 0-17 Years, Davidson County, TN, 2021

	Manner of Death					Total (n=94)
	Natural (n=52)	Accident (n=18)	Suicide (n=3)	Homicide (n=11)	Undetermined (n=10)	
Age Group						
<1 yr	45	9	0	0	9	63
1-4 yrs	2	2	0	1	1	6
5-9 yrs	0	1	0	0	0	1
10-14 yrs	3	3	1	1	0	8
15-17 yrs	2	3	2	9	0	16
Race/Ethnicity						
NHB	21	12	1	10	8	52
NHW	12	2	0	1	1	16
Asian	3	0	0	0	0	3
Hispanic	15	4	2	0	1	22
Pacific Islander	1	0	0	0	0	1
Sex						
Male	30	14	3	9	7	63
Female	22	4	0	2	3	31
Data Source: MPHD, Child Fatality Review Database System						

When all deaths were sorted by manner of death, NHB children accounted for a higher number of deaths than other racial/ethnic groups in each category other than suicide. Infants accounted for over three-quarters of natural deaths (45 of 52 deaths, 87%) and half of accidental deaths (9 of 18 deaths, 50%). Teens aged 15 to 17 years accounted for the highest percentage of homicides (9 of 11 deaths, 82%).

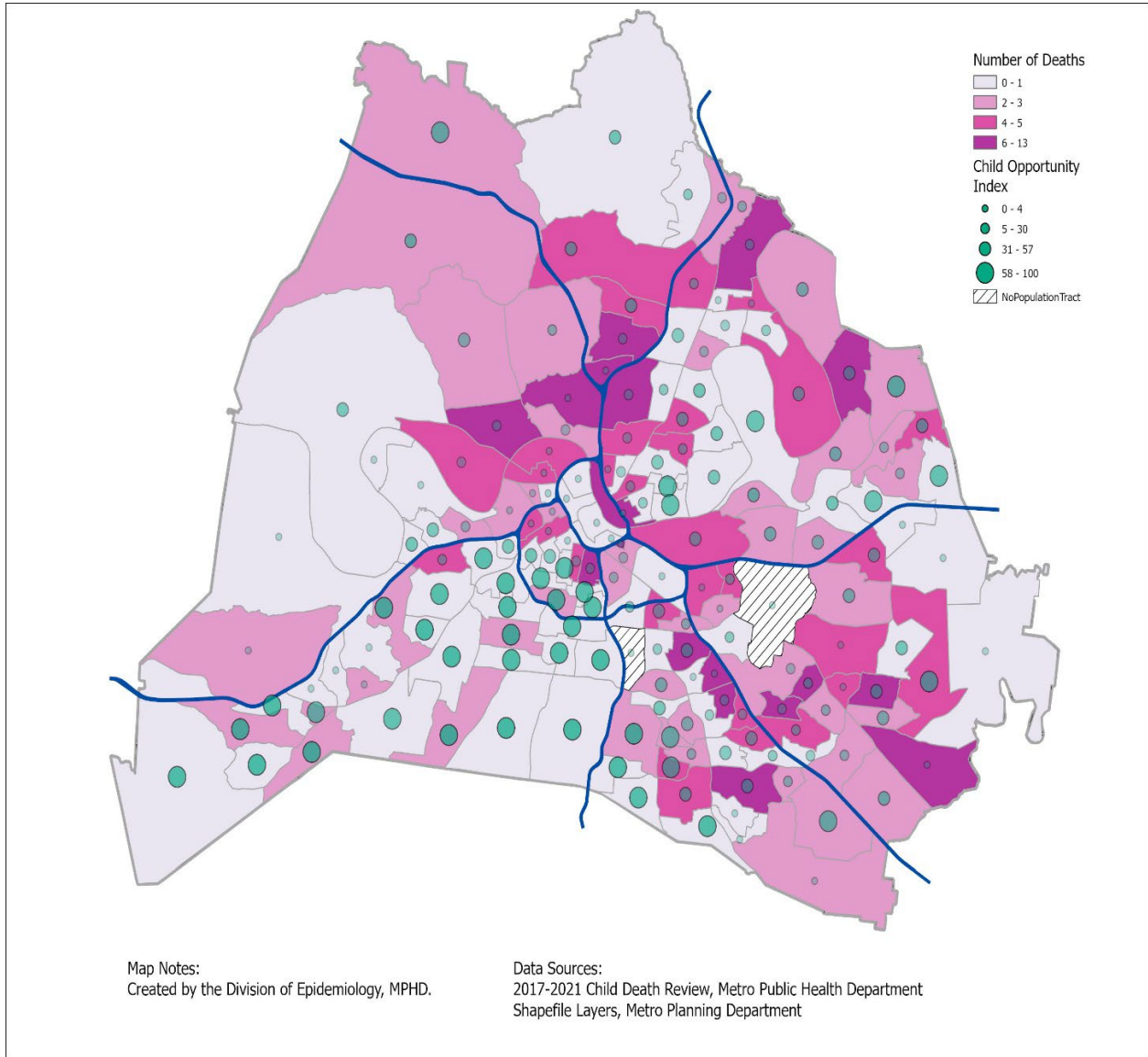
Deaths classified as undetermined accounted for 11% of all deaths reviewed in 2021. Infants represented 90% of undetermined deaths, and all 9 involved unsafe sleeping environments.

Mapping Child Mortality and the Childhood Opportunity Index

Where a child lives can influence their development, quality of their childhood experiences, health and education, and social norms and expectations for the future. Supportive neighborhood resources and conditions have been shown to enhance the effect of protective family factors and mitigate the effects of adverse family circumstances. The Childhood Opportunity Index 2.0 (COI) quantifies neighborhood opportunities for children in three domains: education, health and environment, and socio-economic. Lack of meaningful opportunity in these domains is represented by a low COI score. Census tracts are scored on 29 indicators which are summed to create the overall COI. Scores are then ranked and census tracts are marked as low, medium, or high opportunity areas. A list of the specific indicators included in the index is provided in the appendix, and further details about the source of the index are available in the Technical Notes section of this report.

Neighborhood resources are not equally distributed in Davidson County, which helps to explain the geographic disparity in child mortality. Figure 7 displays the distribution of the COI combined with the number of child deaths by census tract. Areas with the highest number of deaths are shaded in dark pink. Areas with the lowest child opportunity are represented by small green circles. The analysis shows that areas with the highest number of child deaths and the lowest childhood opportunity scores were located in the central, southeastern, and northeastern parts of the county. Areas with no residents, which include airports and the rail yard, are marked with crosshatches.

Figure 7. Number of Child Deaths and Childhood Opportunity Index According to Resident Address at the Time of Death, Davidson County, TN, 2017-2021



Infant Mortality

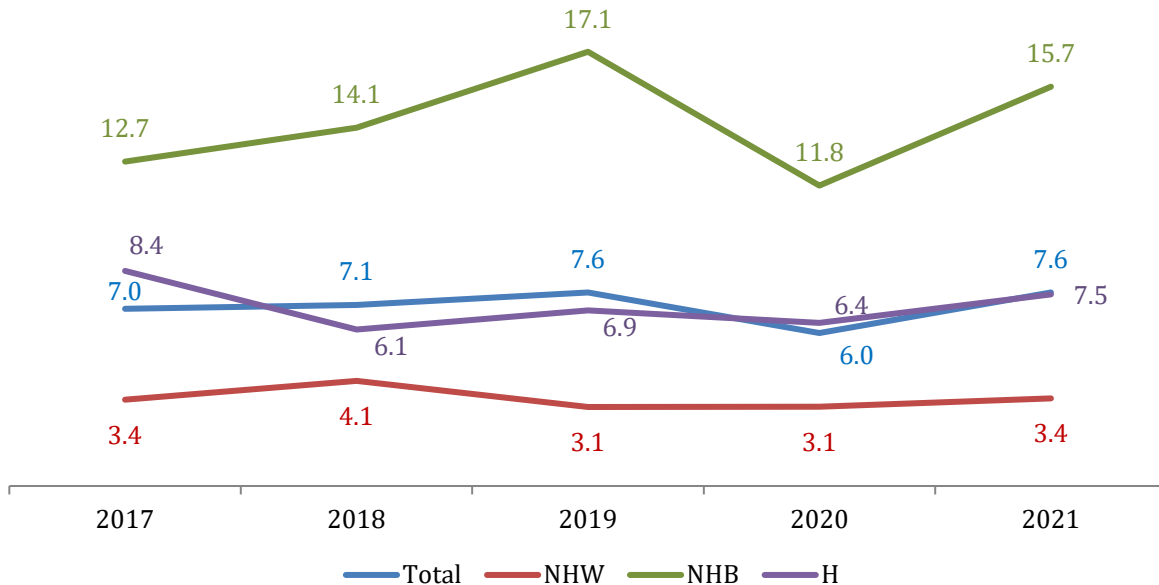
Overall Infant Mortality

The CDRT reviewed 63 infant deaths in 2021, representing 67% of all reviewed deaths. As presented in Figure 2, the infant mortality rate in Davidson County was 7.6 per 1,000 live births in 2021, a 27% increase from 6.0 per 1,000 live births in 2020.

During 2017-2020, infant mortality rates in Davidson County were similar to the rates for Tennessee, but in 2021 the rate in Davidson County was 23% higher. Rates in Davidson County consistently exceeded national rates. In 2021, for example, Davidson County's rate was 41% higher than the national rate (Figure 2, page 14).

As shown in Figure 8, racial and ethnic disparities in infant mortality increased markedly in 2021. The infant mortality rate for NHB infants increased from 11.8 to 15.7 per 1,000 live births compared to a very slight increase among NHW infants. Infant mortality rates among H infants increased from 6.4 to 7.5 per 1,000 live births (17%). In 2021, the NHB infant mortality rate was 4.6 times higher than that for NHW infants. The mortality rate for H infants in 2021 was 2.2 times higher than that for NHW infants.

Figure 8. Infant Mortality Rates per 1,000 Live Births by Race/Ethnicity, Davidson County, TN, 2017-2021



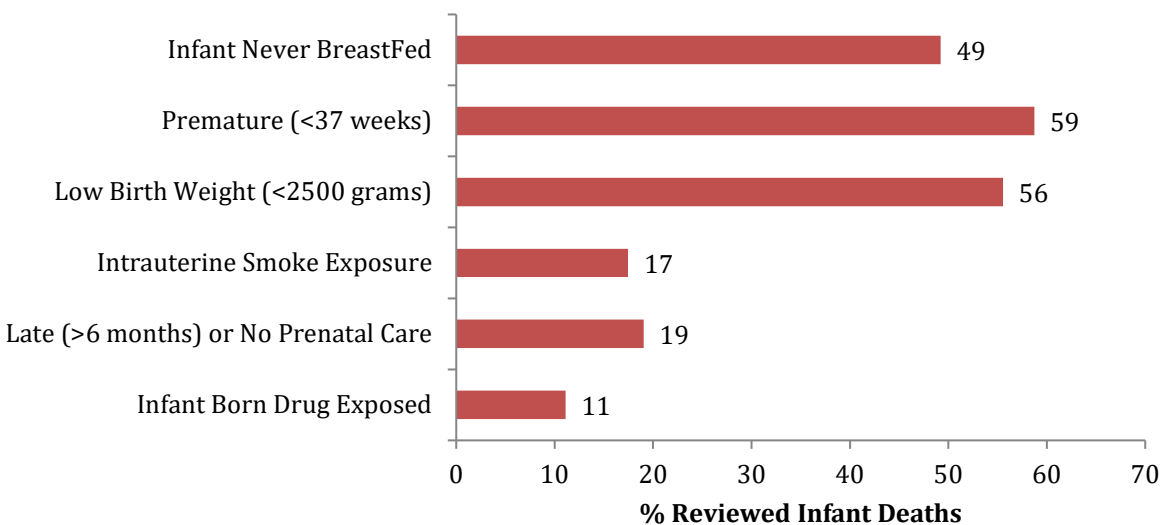
Data Sources: Vital records provided by Tennessee Department of Health.

Factors Associated with Infant Deaths

Infant vitality is influenced by a wide range of factors including maternal health and behaviors, maternal substance use (e.g., smoking, drug abuse), access to pre- and post-natal care, issues related to labor and delivery, and housing conditions. This section of the report presents data on factors associated with infant deaths based on information obtained from CDRT reviews irrespective of the cause and manner of death. Data are compared to all births countywide.

As shown in Figure 9, prematurity (59%), low birth weight (56%), and never having been breastfed (49%) were the predominant risk factors among infant deaths. These percentages were higher than the overall rates of preterm birth (11%), low birth weight (9%), and never having been breastfed (10%) in Davidson County. Additionally, 17% of reviewed infant deaths were associated with intrauterine smoke exposure whereas the maternal smoking rate in Davidson County overall was 4%. Drug exposure was present in 11% of infant deaths; none of the reviewed cases was diagnosed with neonatal abstinence syndrome. Having late or no prenatal care was noted among 19% of mothers with infant deaths, which was higher than the percentage of having late or no prenatal care among all mothers in Davidson County (8%).

Figure 9. Risk Factors Associated with Infant Deaths, All Causes, Davidson County, TN, 2021



Data Source: MPH, Child Fatality Review Database System

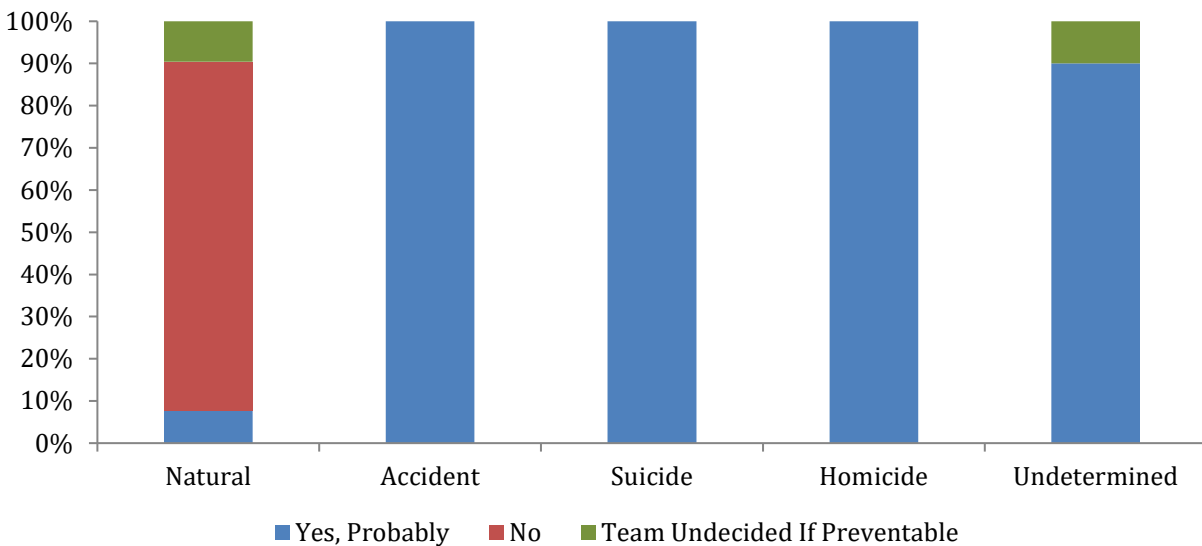
Approximately 30% of infant deaths in 2021 in Davidson County were sleep-related (19 deaths). Reviews identified several factors that created an unsafe sleeping environment, such as co-sleeping, soft bedding, and a sleep position other than on the back. Practicing safe sleep habits for infants is a key component of any intervention to reduce infant mortality. A more detailed examination of sleep-related infant deaths is provided later in this report.

Preventability

The CDRT reviewed each death to determine if the death was preventable. A death is deemed preventable if an individual, community, or system could have identified and modified risk factors and reasonably changed the circumstances leading to death.

The CDRT determined that 45 (48%) of the total 94 deaths reviewed in 2021 were preventable. The CDRT could not determine preventability in 6 deaths (6%) (Figure 10). Notably, 100% of accidents, homicides, and suicides were preventable, as were 90% of deaths with an undetermined manner. This includes sleep-related deaths, for which the manner of death was often classified as accidental or undetermined.

Figure 10. Reviewed Child Deaths by Manner of Death and Preventability, Davidson County, TN, 2021



Data Source: MPHD, Child Fatality Review Database System

Detailed Review of Deaths by Manner and Cause

As stated previously in this report, certifying physicians or medical examiners classified deaths into one of five manners of death: natural, accident, homicide, suicide, or undetermined. The undetermined manner typically includes several sleep-related infant deaths and other cases where the manner was not clear. Sleep-related infant deaths are discussed in a later section of this report, and the remaining undetermined deaths are not discussed further. The frequency distribution of deaths by manner is discussed earlier in this report (Figure 3, Table 2). The following sections describe the specific causes of death within each manner.

Natural Deaths

Manner was classified as natural for 52 deaths reviewed by the CDRT in 2021, representing 55% of the total reviewed deaths. As shown in Table 3, 87% of natural deaths occurred to infants, 58% occurred to males, and 40% occurred to NHB children, followed by H children (29%). The leading causes of natural death were prematurity (18 deaths, 35%), and congenital anomalies (15 deaths, 29%). Cancers accounted for 8% (4 deaths). Other conditions (15 deaths) accounted for 29% and included malnutrition due to underlying medical conditions (2 deaths), neurological disorders (1 death), pneumonia (2 deaths), perinatal conditions (5 deaths), and other medical conditions (4 deaths). In 1 case, the natural mechanism of death was undetermined.

Table 3. Number of Reviewed Deaths Due to Natural Causes by Specific Cause, Summary for Children Aged 0-17 Years, Davidson County, TN, 2021

	Natural Causes of Death					
	Total (n=52)	% of Reviewed Deaths	Congenital Anomaly (n=15)	Prematurity (n=18)	Cancer (n=4)	Other Causes (n=15)
Age Group						
<1 yr	45	87	15	18	0	12
1-4 yrs	2	4	0	0	1	1
5-9 yrs	0	0	0	0	0	0
10-14 yrs	3	6	0	0	2	1
15-17 yrs	2	4	0	0	1	1
Race/Ethnicity						
NHB	21	40	6	7	0	8
NHW	12	23	4	5	1	2
Asian	3	6	2	0	1	0
Hispanic	15	29	3	5	2	5
PI[^]	1	2	0	1	0	0
Sex						
Male	30	58	10	11	0	9
Female	22	42	5	7	4	6
Data Source: MPH/D; Child Fatality Review Database System						
^Native Hawaiian/Pacific Islander						

COVID-19

Within natural deaths, COVID-19 is a specific cause; however, the CDRT recognizes that the COVID-19 pandemic had wide-ranging impacts on the health and well-being of children. This section summarizes the findings of the CDRT on the impact of COVID-19 on service delivery and social systems in the county.

Data on COVID-19 exposure prior to death was missing in approximately 65% of cases, and COVID-19 infection was not identified as the cause of death among 2021 cases. Maternal COVID-19 infection while pregnant was noted in 4 cases, and in 2 cases the child was exposed to a family member positive for COVID-19 within 14 days of death. COVID-19 was noted to have indirectly contributed to 1 death.

Maternal vaccination status was consistently ascertained. Of the 63 reviewed infant deaths, maternal COVID-19 vaccination was missing on 1 death, and approximately 87% of pregnant mothers were not vaccinated.

Of all 94 reviewed deaths, 65% showed no evidence of disruptions or significant changes in systems of care due to COVID-19. Disruptions to education were noted in 2 deaths, and in medical care noted in 3 deaths.

Concern about the pandemic led some families to avoid or delay visits to medical providers. Reviews revealed missed or delayed well-child visits which, in turn, delayed the administration of age-appropriate vaccines. Missed visits could also have delayed the detection and treatment of other illness. Delay or avoidance of prenatal care visits, visits for routine maternal health care and maintenance of chronic health conditions, and visits for mental health treatment were noted. Impacts on social support were also noted with hospitals restricting the number of people who were allowed to be with the mother during labor and delivery, or at the bedside of a hospitalized child.

School closures and the shift to virtual learning disrupted the social network and activities for school-aged children. In some cases the shift created barriers to providing services to children and their families, such as nutritional support, mental health services, and individualized education program (IEP) services.

Infant, child, and family support services such as home visiting and childbirth classes shifted away from an in-person model to virtual platforms. This reduced opportunities for first-hand observation of infants' home and sleeping environments and "hands-on" safe sleep learning. Similarly, DCS noted that clients received face-to-face visits for the initial contact only; once the family was enrolled and receiving services, visits were conducted virtually.

The CDRT recognizes that the pandemic required systems to respond rapidly to dynamically changing situations in a way that protected both the public and employees. However, reviews suggested that in-person contact, in both school and home settings, and uninterrupted medical care are important factors in providing social, medical, and caregiving support and should be considered as priorities.

Deaths Due to Accidents

The CDRT reviewed 18 deaths due to accidents in 2021, representing 19% of the total reviewed deaths. The leading causes of accidental death were suffocation (10 deaths, 56%), followed by motor vehicle crashes (4 deaths, 22%) (Table 4). Male children (14 deaths, 78%), infants under 1 year of age (9 deaths, 50%), and NHB children (12 deaths, 67%) had the highest percentages of accidental deaths compared to other subgroups.

Table 4. Number of Reviewed Deaths Due to Accidents by Cause, Summary for Children Aged 0-17 Years, Davidson County, TN, 2021

Deaths Due to Accidents						
	Total (n=18)	% of Reviewed Deaths	Suffocation (n=10)	Motor Vehicle (n=4)	Poisoning (n=2)	Other Causes (n=2)
Age Group						
<1 yr	9	50	9	0	0	0
1-4 yrs	2	11	1	0	0	1
5-9 yrs	1	6	0	1	0	0
10-14 yrs	3	17	0	1	1	1
15-17 yrs	3	17	0	2	1	0
Race/Ethnicity						
NHB	12	67	7	2	1	2
NHW	2	11	1	1	0	0
Asian	0	0	0	0	0	0
Hispanic	4	22	2	1	1	0
Sex						
Male	14	78	7	3	2	2
Female	4	22	3	1	0	0

Data Source: MPHD; Child Fatality Review Database System

Motor Vehicle

The CDRT reviewed 4 deaths due to motor vehicles. The child was a passenger in 3 incidents and the driver of the vehicle in 1 incident. Speeding was cited as a contributing factor in 1 incident. Carelessness and failure to maintain proper lane were each cited in 1 incident. Drug or alcohol impairment was noted in 2 incidents. Driving conditions were normal in all 4 incidents. The actions of the child caused the crash in 1 case, multiple drivers were responsible in 1 incident, and in 2 incidents the child's driver was responsible. In 2 incidents the responsible driver was driving without a license, and in 1 incident the driver was operating the vehicle with a suspended license. Correct seatbelt use was evident in 3 incidents, and in 1 incident the child was properly restrained in an age-appropriate booster seat.

Drowning

The drowning death occurred during horseplay at a private pool. The child was reportedly unable to swim; no floatation devices were used.

Suffocation

The CDRT reviewed 10 child deaths due to accidental suffocation. Two deaths were due to choking. The Heimlich maneuver was attempted in both incidents. The remaining 8 deaths were sleep-related, and further discussion can be found in the sleep-related death section of the report.

Firearm

One death was due to the accidental discharge of a firearm. The loaded gun was left in reach of the child while one parent was distracted and one was absent from the room.

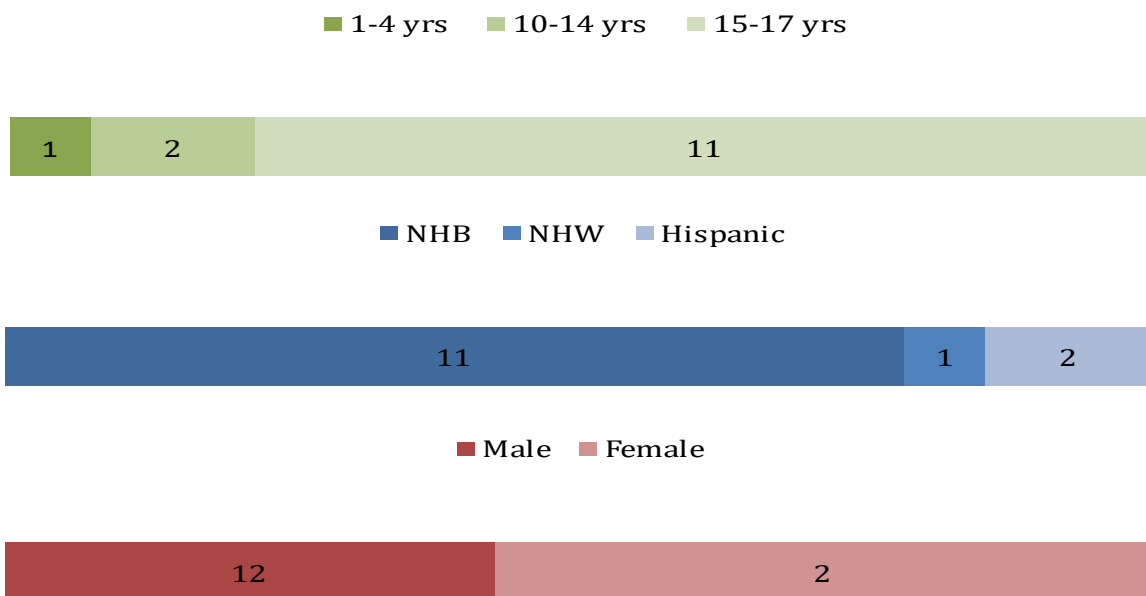
Poisoning

Two deaths were due to accidental poisoning. One death resulted from carbon monoxide exposure from generator use. The other death resulted from an overdose of fentanyl in a child with untreated mental health issues, and both the child and members of the family had histories of substance use.

Deaths Due to Violence—Homicides and Suicides

The CDRT reviewed 14 deaths (15% of all reviewed 2021 deaths) that occurred to children as the result of violence. Deaths occurred most frequently among children aged 15-17 years (11 deaths), followed by the 10-14 (2 deaths) and 1 to 4 (1 death) age groups. More deaths occurred to males (12 deaths), and NHB children (11 deaths) (Figure 12). Regarding the mechanism of death, violence-related deaths consisted of homicides and suicides, which are described in detail below. A single death may have multiple contributing factors; therefore, the categories are not mutually exclusive.

Figure 11. Demographic Distribution of Violent Deaths for Children Aged 0-17 Years, Davidson County, TN, 2021



Data Source: MPHD, Child Fatality Review Database System

Homicides

In 2021, 11 deaths were due to homicide, representing 79% of deaths due to violence and 12% of all reviewed deaths. Most of these deaths occurred to males (9 deaths), NHB (10 deaths), and children aged 15 to 17 years (9 deaths).

Firearms were used in all 11 incidents. Motives for the homicides included commission of a crime (3 incidents), drug dealing (1 incident), an argument (2 incidents), intimate partner violence (1 incident), playing with the weapon (2 incidents), gang-related activity (1 incident), and random violence (1 incident). Motives were undetermined for 1 incident.

Most of the homicides were committed by someone known to the victim. Family members were cited in 3 incidents, and friends and acquaintances were cited in 5 incidents. The perpetrator was a stranger to the victim in 2 incidents. The relationship of the perpetrator to the child was unknown in 1 incident.

Weapon use was commonly noted to occur during the commission of another crime (7 incidents). Cited crimes were robbery (3 incidents), interpersonal violence (2 incidents), gang conflict (1 incident), auto theft (1 incident), and the drug trade (1 incident).

Detailed reviews revealed that victims were often experiencing one or more behavioral, social, or school-related issues prior to death. The victim was noted to have problems in school in 9 deaths; all 9 were noted to have behavioral issues and issues with truancy, 7 victims experienced academic issues, 6 were previously suspended from school, and 4 had previously been expelled. Additional issues cited included a history of substance abuse (5 incidents), and a history of criminal or delinquent activity (6 incidents). Five victims were noted to have spent time in juvenile detention, and 1 had been removed from the home prior to death. Eight of the children were previous victims of child maltreatment. Child maltreatment is discussed in detail later in this report.

In some of the homicide deaths, the victims or their families were receiving services from public agencies prior to death. Four had received mental health services. The Department of Children's Services (DCS) was not involved with any of the families at the time of the incident (e.g., investigating allegations of child abuse and neglect, providing foster-care or family preservation services, or ensuring child safety).

Suicides

There were 3 suicide deaths in 2021, representing 21% of deaths due to violence and 3% of all deaths reviewed. More suicide deaths occurred to children aged 15 to 17 years (2 deaths), Hispanic children (2 deaths), and males (3 deaths). One death was due to strangulation, and 2 deaths were due to firearms.

One victim had a previous nonfatal suicide attempt, and 1 victim had communicated suicidal thoughts or intentions. None of the deaths was known to be premeditated, and all of the suicide acts were likely to have been observed by others. Changes in behavior prior to the suicide were noted in 2 incidents, and in 1 incident the child displayed severe emotional distress. Social media was noted as a factor in 1 death. In 1 incident the child experienced a known crisis in the 30 days prior to death--the death of a loved one by suicide.

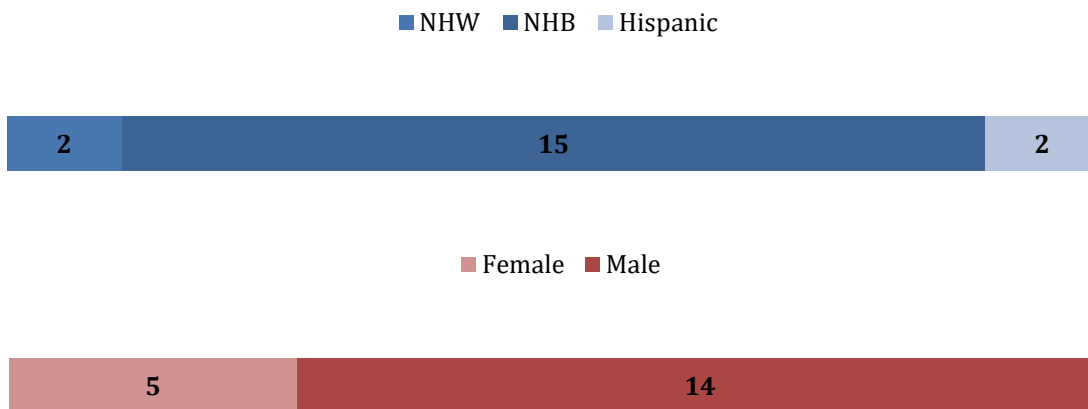
Similar to homicide victims, suicide victims were noted to have social, behavioral, or school problems prior to death. Three victims experienced problems in school including academic issues (1 incident), truancy (2 incidents), and behavioral issues (2 incidents). One victim had a history of self-mutilation, and, on average, each victim suffered from at least 2 mental health diagnoses, including anxiety, bipolar spectrum disorder, impulse control or conduct disorder, autism spectrum disorder, and gender dysphoria. In 1 incident the child was a

previous victim of child maltreatment. Child maltreatment is discussed in detail later in this report. All 3 victims had received mental health services. None of the families was noted to be involved with DCS prior to the death.

Infant Deaths Due to Sleep-Related Factors

Of the 63 infant deaths reviewed by the CDRT in 2021, 19 (30%) were determined to be sleep-related. The manner of death was accidental in 8 deaths, natural in 2 deaths, and the remaining 9 deaths were categorized as undetermined. Of these 19 deaths, most (15 deaths) occurred to NHB infants, and males (14 deaths) (Figure 13).

Figure 12. Demographic Distribution of Sleep-Related Infant Deaths, Davidson County, TN, 2021



Data Source: MPHD, Child Fatality Review Database System

Table 5 displays the frequency of selected sleep-related factors that contributed to the deaths. Eighty-four percent of sleep-related deaths occurred in unsafe bedding, and 68% occurred when the child was sleeping somewhere other than a crib or bassinette, including an adult bed (58%), the floor (5%), or playpen (5%). A crib or other safe place to sleep was available in the home in 74% of cases. In 26% of cases, the home was overcrowded, which may have significantly reduced the space for a crib or pack-n-play placement.

Table 5. Selected Factors Involved in Sleep-Related Infant Deaths, Davidson County, TN, 2021

Factors Involved in Sleep-Related Infant Deaths		
	Total (n=19)	% of Reviewed Deaths
Sleeping in unsafe bedding	16	84
Not in a crib or bassinette	13	68
Not sleeping on the back	10	53
Sleeping with other people	10	53
Crib present in the home	14	74
Exposed to second-hand smoke	5	26
Residence overcrowded	5	26
Supervising adult was drug or alcohol-impaired	3	16

Categories are not mutually exclusive
 Data Source: MPH/D; Child Fatality Review Database System

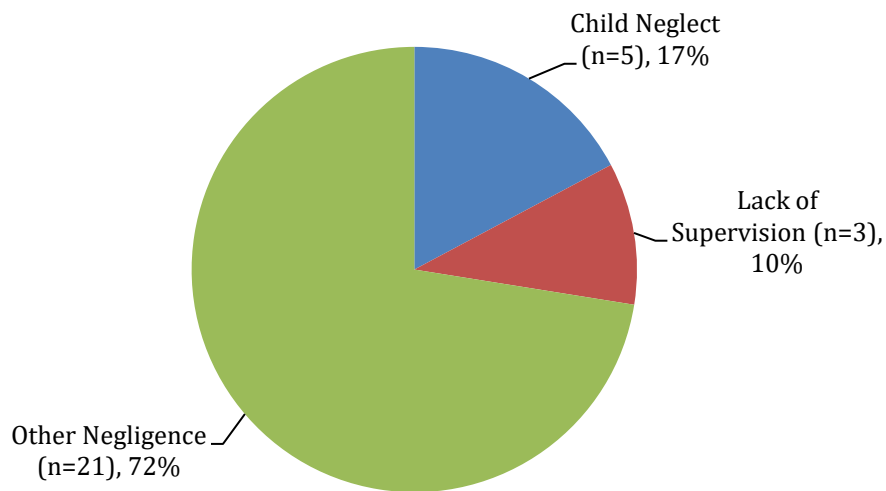
Additionally, 53% of infants were not sleeping on their backs, and 53% were sleeping with other people at the time of death. Approximately 26% of the infants were exposed to second-hand smoke in the home. Three infants were under the care of a drug or alcohol-impaired adult at the time of death.

DCS was not involved with any of the families at the time of the incident. In 90% of cases, the family was receiving services from the Women, Infants, and Children program (WIC) within the 12 months prior to the death.

Child Abuse and Neglect

Among the 94 deaths reviewed, the CDRT found 29 deaths (31%) having some evidence of maltreatment, defined as abuse, neglect, or other form of negligence. Of those 29 deaths, 17% involved child neglect, 10% involved a lack of proper supervision, and 72% involved other negligence such as exposure to unsecured medication in the home, exposure to water or motor vehicle hazards, maternal substance use during pregnancy, or unsafe infant bedding (Figure 14).

Figure 13. Percentage of Deaths with Evidence of Child Maltreatment among Children Aged 0-17 Years, Davidson County, TN, 2021



Data Source: MPHD, Child Fatality Review Database System

Table 6 displays the demographic information for reviewed deaths associated with child abuse, child neglect, lack of supervision, or other negligence. The majority of these deaths occurred to infants (69%), males (72%), and NHB children (62%).

Table 6. Number of Reviewed Deaths with Evidence of Child Maltreatment among Children Aged 0-17 Years, Davidson County, TN, 2021

Deaths with Evidence of Maltreatment (n=29)		
	Total	% of Reviewed Deaths
Age Group		
<1 yr	20	69
1-4 yrs	4	14
5-9 yrs	1	3
10-14 yrs	3	10
15-17 yrs	1	3
Race/Ethnicity		
NHB	18	62
NHW	5	17
Asian	0	0
Hispanic	6	21
Sex		
Male	21	72
Female	8	28

Data Source: MPHD, Child Fatality Review Database System

In 82% of the deaths, the offender was the child’s biological parent or primary caregiver. In the remaining cases, the offender was the child’s supervisor at the time of death (18%), or a friend (3%). In 21% of the deaths, the person causing or contributing to the death of the child was drug or alcohol-impaired. DCS was involved with the family prior to death in 4% of the incidents. Among children exposed to other negligence (21 deaths), 71% involved unsafe sleeping environments, 19% involved unsecured firearms, and 5% each involved motor vehicle hazards or maternal substance abuse during pregnancy.

Conclusion

The CDRT strives to understand both the causes of death among Davidson County's children and the landscape of community systems and services that support children and their families. Our goal is to identify strategies and systems changes that can prevent excess injury and suffering among children, and future tragic outcomes. The data contained in this report highlight several key areas that warrant further attention and indicate a need for the community to prioritize childhood morbidity and mortality as a strategic focus.

Despite declines in the childhood mortality rate in Davidson County, rates were consistently higher than rates for Tennessee and the nation. Disparities in overall child mortality and infant mortality between NHB and NHW children are persistent. Nearly half of the total reviewed 2021 deaths were preventable, including the 30% of infant deaths which were related to unsafe sleep environments or practices.

The year 2021 presented unique and dynamic challenges due to the ongoing COVID 19 pandemic. The community experienced a complex combination of an overburdened healthcare system, pandemic mitigation efforts, and changes in both health seeking behaviors and healthcare and social support system delivery. The Team recognizes the herculean efforts of the medical and social service providers during the pandemic. Without their dedicated efforts, the outcomes in this report would likely be much worse. However, it is important to acknowledge that the mosaic of circumstances related to COVID-19 had an impact on the health and wellbeing of children and their families in Davidson County.

The review process allowed identification of key areas for future interventions to reduce the number of preventable deaths. These include efforts to increase first-trimester prenatal care utilization, interventions to increase the utilization of safe sleep practices among infants, promotion of vehicle safety, and support of programs, policies, and practices in the community aimed at building youth resilience and reducing community violence. The COVID-19 pandemic highlighted deficiencies in the ability of systems to manage pandemics in such a way that minimizes the impact of service delivery to families.

Technical Notes

Data Sources

The data presented in this report are compiled from many different sources. Errors in the data are sometimes identified and corrected through the child death review process or other quality control systems, and the data presented in this report might differ from data published from other sources.

Data from reviews are abstracted into a standard data collection form and entered into a database hosted by The National Center for Fatality Review and Prevention.

National and state data are from the National Vital Statistics System Database, CDC WONDER, and reports from the Tennessee Child Fatality Review Team.

Child and infant mortality rates were calculated from the Davidson County vital records files; those estimates include deaths excluded from CDRT review. Population estimates for 2017-2019, and 2021, are from the American Community Survey (ACS); single-year estimates are used to calculate child mortality rates where appropriate. For 2020 data, ACS estimates were not available, and the National Center for Health Statistics (NCHS) bridged-race population estimates were used. Infant mortality rates were calculated from the total number of infant deaths divided by the total number of live births.

The Childhood Opportunity Index (COI) 2.0 measures neighborhood resources and conditions important for child development at the census tract level. The index includes 29 indicators across 3 domains and is available for nearly all neighborhoods in the United States. COI scores were geospatially analyzed in conjunction with the frequency of child deaths and symbolized in the map (Figure 7). Technical notes for the COI, supporting documentation, and a mapping utility, can be found at diversitydatakids.org.

Data Limitations

The indicators in this report are based on single-year counts of county-level data; the counts in certain categories in some years are limited. Rates based on counts less than 20 are considered unstable and should be interpreted with caution; percentages and rates may change drastically from year to year.

Data Interpretation

Data collected by the CDRT represent an extreme outcome among children and youth, and caution should be used when extrapolating these results to health outcomes among the general population. However, the data collected by the CDRT illustrate areas where the systems, policies, and practices of a community fail to protect children adequately. As such, this information provides valuable evidence to promote and advocate for systems change.

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Appendix

Appendix 1. Organizations and Agencies Serving on the Child Death Review Team

Participating Organizations	
Metro Public Health Department	Department of Children’s Services
Metro Nashville Police Department	Monroe Carrell Jr. Children’s Hospital at Vanderbilt
Metro Nashville Public Schools	Vanderbilt University Medical Center
Metro Office of Family Safety	St. Thomas Midtown Hospital
Metro Social Services	Nurses for Newborns
Office of the District Attorney Nashville	Children’s Clinic East
Juvenile Court of Metropolitan Nashville and Davidson County	Nashville Children’s Alliance
Nashville Fire Department	Child Protective Investigative Team
Davidson County Medical Examiner’s Office	Youth Villages

Appendix 2. List of COI 2.0 Indicators and Domains

	INDICATOR	DESCRIPTION
EDUCATION	Early childhood education (ECE)	
	ECE centers	Number of ECE centers within a 5-mile radius
	High-quality ECE centers	Number of National Association for the Education of Young Children (NAEYC) accredited centers within a 5-mile radius
	ECE enrollment	Percent 3- and 4-year-olds enrolled in nursery school, preschool or kindergarten
	Elementary education	
	Third grade reading proficiency	Percent third graders scoring proficient on standardized reading tests, converted to National Assessment of Educational Progress (NAEP) scale score points
	Third grade math proficiency	Percent third graders scoring proficient on standardized math tests, converted to NAEP scale score points
	Secondary and postsecondary education	
	High school graduation rate	Percent ninth graders graduating from high school on time
	Advanced Placement (AP) course enrollment	Ratio of students enrolled in at least one AP course to the number of 11th and 12th graders
	College enrollment in nearby institutions	Percent 18-24 year-olds enrolled in college within 25-mile radius
	Educational and social resources	
School poverty	Percent students in elementary schools eligible for free or reduced-price lunches, reversed	
Teacher experience	Percent teachers in their first and second year, reversed	
Adult educational attainment	Percent adults ages 25 and over with a college degree or higher	
HEALTH & ENVIRONMENT	Healthy environments	
	Access to healthy food	Percent households without a car located further than a half-mile from the nearest supermarket, reversed
	Access to green space	Percent impenetrable surface areas such as rooftops, roads or parking lots, reversed
	Walkability	EPA Walkability Index
	Housing vacancy rate	Percent housing units that are vacant, reversed
	Toxic exposures	
	Hazardous waste dump sites	Average number of Superfund sites within a 2-mile radius, reversed
	Industrial pollutants in air, water or soil	Index of toxic chemicals released by industrial facilities, reversed
	Airborne microparticles	Mean estimated microparticle (PM2.5) concentration, reversed
	Ozone concentration	Mean estimated 8-hour average ozone concentration, reversed
	Extreme heat exposure	Summer days with maximum temperature above 90F, reversed
Health resources		
Health insurance coverage	Percent individuals ages 0-64 with health insurance coverage	
SOCIAL & ECONOMIC	Economic opportunities	
	Employment rate	Percent adults ages 25-54 who are employed
	Commute duration	Percent workers commuting more than one hour one way, reversed
	Economic and social resources	
	Poverty rate ^a	Percent individuals living in households with incomes below 100% of the federal poverty threshold, reversed
	Public assistance rate ^a	Percent households receiving cash public assistance or Food Stamps/Supplemental Nutrition Assistance Program, reversed
	Homeownership rate ^a	Percent owner-occupied housing units
	High-skill employment ^a	Percent individuals ages 16 and over employed in management, business, financial, computer, engineering, science, education, legal, community service, health care practitioner, health technology, arts and media occupations
Median household income ^a	Median income of all households	
Single-headed households	Percent family households that are single-parent headed, reversed	

Notes: Some indicators are reversed when combining them into the index so that more of that indicator always means more opportunity. ^aThese five indicators are combined into an economic resource index. Table adapted from the Child Opportunity Index 2.0 Technical Documentation.