Child Fatality Prevention System:

Sudden Unexpected Infant Death Data, 2015 - 2019

Introduction

The Child Fatality Prevention System (CFPS) is a statewide network that focuses on preventing child deaths. Housed at the Colorado Department of Public Health and Environment (CDPHE), CFPS consists of local review teams, a State Review Team, and the CFPS state support team at CDPHE. Local teams include community members and field experts. These teams complete case reviews of infant, child, and youth deaths in Colorado to describe trends and patterns and create strategies to prevent future deaths. The CFPS State Review Team develops recommendations for the legislature on how to prevent child deaths in an annual legislative report.

The system reviews all deaths that occur in Colorado among infants, children, and youth under age 18. CFPS does not review deaths of Colorado residents that occur out of state. This is different from other reports of child death data and other Colorado government data sources. As a result, the data presented in this data brief might not match other statistics reported at both the state and national levels.

This data brief provides an overview of sudden unexpected infant death (SUID) data from CFPS. Additional CFPS data are available at: www.cochildfatalityprevention.com/p/reports.html.

For purposes of this brief, ***inequities*** are defined as systemic, avoidable, and unjust factors that prevent people from reaching their highest level of health. ***Disparities*** are differences in health outcomes between people related to social or demographic factors such as race, ethnicity, gender, sexual orientation, or geographic region. Measuring disparities helps measure our progress toward achieving equity.[1,2]

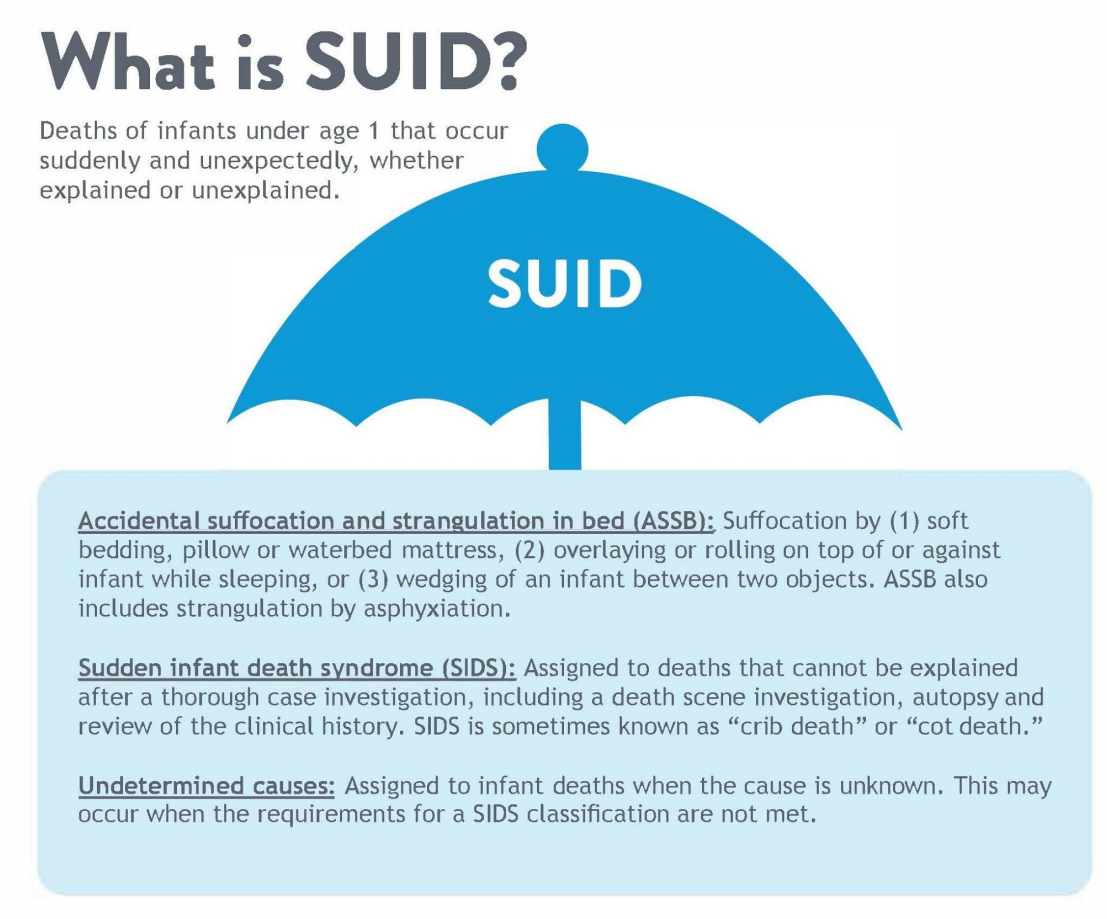
The impact of policies and systems on child deaths

Generations of social, economic, and environmental inequities contribute to the deaths of infants, children, and youth.[3] People exposed to these factors (outlined in the table below) experience additional harm, resulting in higher rates of death. When interpreting the data, it is critical to not lose sight of these systemic, avoidable, and unjust factors. Researchers work towards understanding how geography, race, ethnicity, sexual orientation, and gender identity correlate with health. It is critical that data systems like CFPS identify and understand the life-long inequities that persist across groups in order to eliminate them. When limitations in the data system exist due to how data are collected, or because data are not collected, CFPS strives to provide additional context and research about how inequities impact child deaths. By changing policies and systems that create and perpetuate inequities, CFPS can reduce the number of child deaths that occur in Colorado. Examples of these inequities include, but are not limited to:

RURAL AND FRONTIER GEOGRAPHY	RACE AND ETHNICITY	SEXUAL ORIENTATION AND GENDER IDENTITY
Limited access to Level 1 trauma centers and mental and behavioral health services.[4] Increased stigma associated with mental illness and seeking help.[5] Longer response times by emergency medical services.[6] **→ These and other factors contribute to higher death rates in rural areas, including suicide[7] and passenger vehicle deaths.[8]**	Racism, discrimination, and historical trauma.[9,10] Limited access to high-quality education,[11] employment opportunities,[12] healthy foods,[13] culturally traditional foods,[14] and health care.[15] Chronic stress.[16] **→ These factors result in lasting health impacts for people of color that include infant mortality,[17] high rates of homicide and gun violence,[18] and increased motor vehicle deaths.[19]**	Discrimination, stigma, and bias.[20] Rejection from family, friends, and community.[21] Non-inclusive school curricula and anti-harassment policies.[22] Insufficient access to LGBTQ+-informed health care.[23] **→ This chronic social stress that LGBTQ+ children and youth experience influences health across the lifespan, including higher rates of suicide[24] and substance use.[25]**

Overview of SUID

Sudden unexpected infant death (SUID) describes deaths of infants under age 1 that occur suddenly and unexpectedly, whether explained or unexplained.[26] These deaths often occur during sleep, however this is not always the case. SUID is an umbrella term that combines deaths due to accidental suffocation and strangulation in bed (ASSB), sudden infant death syndrome (SIDS), and deaths due to undetermined causes.[27-30]



SUID is one of the leading causes of infant mortality in the United States. Infant mortality indicates not just the health and wellbeing of families, caregivers, and their children, but is also considered an important indicator of overall health and wellbeing of a nation. Understanding why infants die from SUID in the United States and Colorado, among other leading causes of infant mortality, provide insights into ways in which we can improve health for all.

From 2015-2019, CFPS identified and reviewed 237 SUID. This represents 14.3% of all infant deaths (under age 1) in Colorado for the period. The annual rate of SUID occurring in Colorado among residents increased significantly over this period, from 52.6 per 100,000 live births in 2015 to 95.4 per 100,000 live births in 2019 (Table 1). The overall rate of SUID from 2015-2019 was 69.3 per 100,000 live births. Colorado's rate of SUID during this period is less than the national SUID rate (91.2 per 100,000 live births from 2014-2018).[31]

Table 1. Rates of SUID occurring in Colorado among Colorado residents by year, 2015-2019

Year of Death	n	Live Births	Rate*	95% Confidence Interval	
				Lower Limit	Upper Limit
2015-2019	224	323,314	69.3	60.2	78.4
2015	35	66,567	52.6	35.2	70.0
2016	47	66,613	70.6	50.4	90.7
2017	43	64,388	66.8	46.8	86.7
2018	39	62,871	62.0	42.6	81.5
2019	60	62,875	95.4	71.3	119.6

*Per 100,000 live births among residents in Colorado, 2015-2019.
Data sources: Colorado Child Fatality Prevention System and Vital Statistics Program, Colorado Department of Public Health and Environment.

SUID Risk and Protective Factors

In 2011, the American Academy of Pediatrics (AAP) developed recommendations for a safe infant sleeping environment to help reduce the risk of SUID. Recommendations include on-the-back sleep positioning, using a firm sleep surface, room-sharing without bed-sharing, and avoiding soft bedding and overheating.[32] With a quickly expanding body of SUID prevention research, the AAP expanded upon these recommendations in 2016.[33] The 2016 A-level recommendations, listed below, were used for this report.

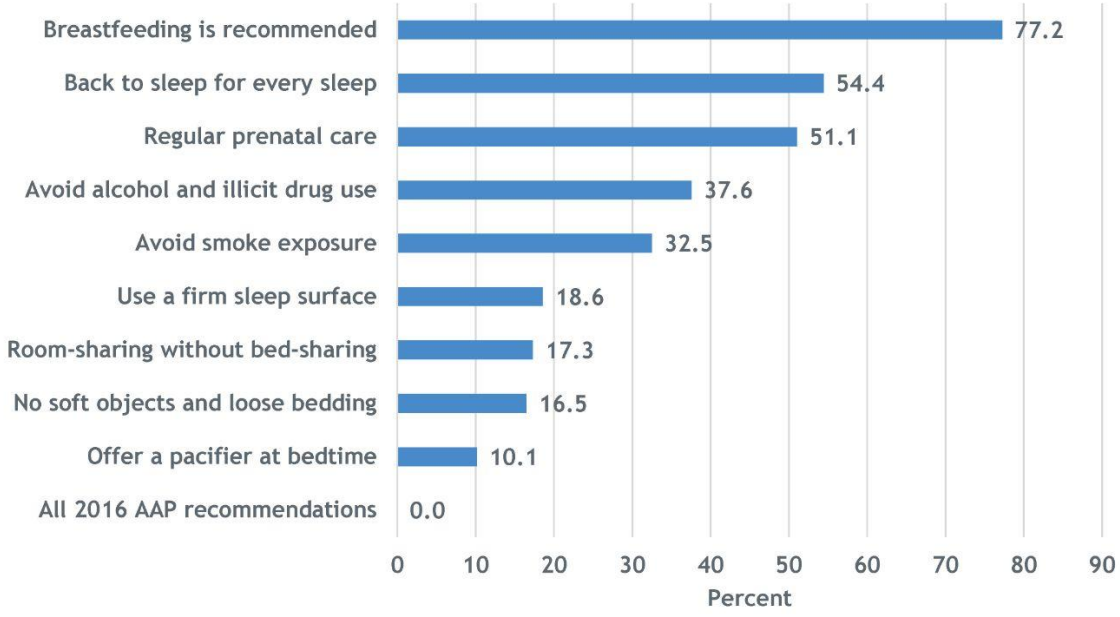
Level A Recommendations:

- Back to sleep for every sleep.
- Use a firm sleep surface.
- Room-sharing (to age 6 months) with the infant on a separate sleep surface (to 1 year).
- Keep soft objects and loose bedding away from the infant's sleep area.
- Pregnant women should seek and obtain regular prenatal care.
- Avoid smoke exposure during pregnancy and after birth.
- Avoid alcohol and illicit drug use during pregnancy and after birth.
- Breastfeeding.
- Consider offering a pacifier at nap time and bedtime.
- Avoid overheating.
- Caregivers should immunize infants in accordance with AAP and CDC recommendations.
- Do not use home cardiorespiratory monitors as a strategy for reducing the risk of SIDS.
- Health care providers, staff in newborn nurseries and NICUs, and child care providers should endorse and model the SIDS risk-reduction recommendations from birth.

- Media and manufacturers should follow safe sleep guidelines in their messaging and advertising.
- Continue the "Safe to Sleep" campaign, focusing on ways to reduce the risk of all sleep-related infant deaths, including SIDS, suffocation, and other unintentional deaths. Pediatricians and other primary care providers should actively participate in this campaign.

Although the availability of sleep environment data varies by investigation, Figure 1 indicates that none of the 237 infants who died between 2015 and 2019 slept in a space that met all of the AAP's Level A Recommendations for a safe infant sleeping environment.

Figure 1. Proportion of SUID occurring in Colorado where safe sleep environment recommendation was satisfied, 2015-2019 (n=237)



Demographic Characteristics

Age and Sex

Consistent with national trends, the majority of SUID occurred among those under five months of age (71.7%, n=170).[34] Males account for the majority of SUID occurring in Colorado, representing 54.0% (n=128) of all SUID.

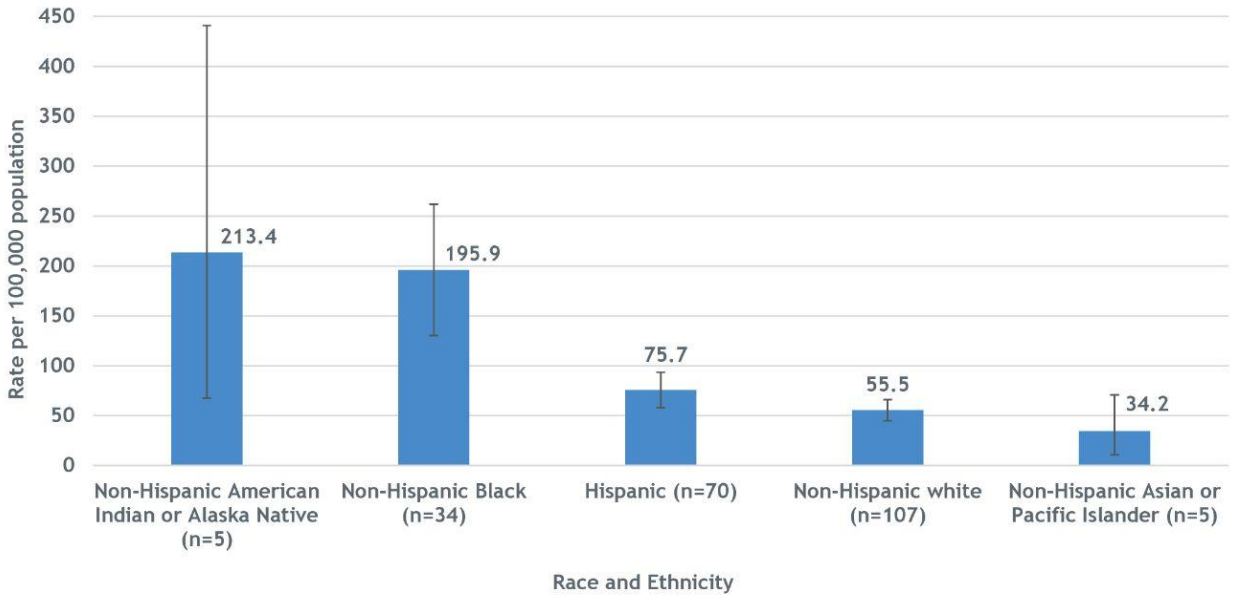
Race and Ethnicity

A note about terminology: Hispanic ethnicity as collected on the Colorado death certificate includes those that identify as Mexican, Mexican American, Chicano, Chicana, Puerto Rican, Dominican, Cuban, Central American, South American, Latin American, Spanish, and other Latin or Hispanic descent.[35] Additionally, "Latinx" and "Chicanx" are increasingly used gender inclusive terms, respecting those with a non-binary gender identity.[36,37] To ensure clarity, this report uses "Hispanic" throughout the data section to reflect how CFPS data are collected from the death certificate and to align with terminology used in cited literature and research.[38]

Between 2015 and 2019, the majority of infants who died by SUID in Colorado were non-Hispanic white (48.5%, n=115), 31.2% (n=74) were of Hispanic origin, 14.4% (n=34) were non-Hispanic Black, 2.5% (n=6) were non-Hispanic American Indian or Alaska Native (AI/AN), and 2.1% (n=5) were non-Hispanic Asian or Pacific Islander.

Colorado observed a significant disparity in the rate of SUID by race and ethnicity (Figure 2). The rate of SUID among non-Hispanic Black infants was 3.5 times higher (195.9 per 100,000 live births) than for non-Hispanic white infants (55.5 per 100,000 live births). Additionally, the rate of SUID among non-Hispanic AI/AN infants was 3.8 times higher (213.4 per 100,000 live births) than for non-Hispanic white infants. These patterns are consistent with national data showing the highest SUID rates among non-Hispanic AI/AN and non-Hispanic Black infants.[39]

Figure 2. Rates of SUID occurring in Colorado among Colorado residents by race and ethnicity, 2015-2019 (n=224)



*Error bars represent 95% confidence limits for rates.

Research highlights the role that social determinants and contextual factors, particularly historical, community, and environmental inequities, play in infant mortality prevention.[40] The purpose of highlighting the following research is to supplement and contextualize the racial and ethnic disparities observed in CFPS data in the rate of SUID.

The increased likelihood of SUID among AI/AN populations may stem from the historical loss of population, land, and culture that was endured by these communities.[41,42] This historical trauma includes the forcible removal of indigenous AI/AN people from their lands in the United States, and the forcible transfer of children from their families to boarding schools designed to strip them of their culture.[43] This trauma shapes the current societal context and leads to substantial socioeconomic and health disparities, including increased infant mortality.[44]

People of color who self-report experiencing unfair treatment, racism, and discrimination across the lifespan have a greater risk for poor mental and physical health.[45] There is a growing body of research showing that the chronic stress created by these everyday experiences of racism contribute to allostatic load, or "wear and tear" on the body.[46] When a person is stressed, their body releases stress hormones, including epinephrine, adrenaline, and cortisol, which normally act to protect the body. However, experiencing chronic stress causes these hormones to continuously pump into the body, no longer protecting the individual, but rather causing damage.[47] These biological processes attributed to chronic stress are associated with negative birth outcomes, including low birthweight and preterm birth, which in turn influence the risk of SUID.[48] Increased cortisol levels due to chronic stress across the lifespan are further compounded by community level inequities, such as poverty. Black women have historically been disproportionately exposed to neighborhood poverty, a well-established risk factor for infant mortality.[49] This factor is completely independent of individual measures of socioeconomic status. Data show 17.9% of AI/AN and 18.5% of Black Coloradans live below the poverty level, compared to 7.1% of non-Hispanic white Coloradans.[50]

In addition to neighborhood poverty, conditions created by racial residential segregation can influence infant mortality. Racial residential segregation is largely driven by discriminatory federal, state, and local policies, such as redlining, that create unjust geographic divisions among racial and ethnic groups.[51,52] Racial segregation leads to neighborhood disadvantage by concentrating neighborhood poverty, increasing exposure to environmental stressors such as air pollutants, creating barriers to and fewer opportunities for a healthy lifestyle, limiting access to health services, and increasing housing and food insecurity.[53] The consequences of residential segregation resulting from historical practices like redlining continue to reverberate throughout communities of color today. As just one example, the Colorado Behavioral Risk Factor Surveillance System (BRFSS) shows that 45.7% of AI/AN and 36.2% of Black Coloradans are food insecure, meaning that they lack reliable access to affordable, nutritious food, compared to 19.2% of non-Hispanic white Coloradans.[54,55] Such community

inequities are associated with preterm birth and low birth weight, which increase the risk of SUID and infant mortality among AI/AN and Black populations.[56,57]

Differences in the prevalence of on-the-back sleep positioning and other sleep environment factors across racial and ethnic populations may also contribute to disparities. Focus groups conducted with Black and AI/AN families highlight that infant sleep decisions are often driven by culture and perceptions of what makes the infant comfortable and safe.[58]

The Pregnancy Risk Assessment Monitoring System (PRAMS) tracks several aspects of infant sleep position and environments among families in Colorado. From 2018-2019, 88.6% of mothers in Colorado reported that they most often lay their infants down to sleep on their backs, with 90.9% of non-Hispanic white mothers and 65.5% of Black mothers reporting on-the-back placement for sleeping. The regular use of a safe sleep location is more common among non-Hispanic white families. From 2018-2019, 88.3% of mothers in Colorado reported usually placing their infant to sleep in a crib, bassinet, or pack and play in the last two weeks, with 91.4% of non-Hispanic white mothers and 76.1% of Black mothers reporting use of these sleep locations.[59] The use of soft bedding is also more common among Black families in Colorado, which is consistent with national trends.[60,61] Too few AI/AN mothers were surveyed by PRAMS to report in accordance with applicable privacy standards to share information about how their infants sleep. However, national research illuminates similar differences in safe sleep practices. For instance, AI/AN mothers report the highest prevalence of bed sharing, when compared to other racial and ethnic groups.[62] Based on this data, safe sleep education and awareness programs should collaborate with communities of color on the best methods to increase safe sleep practices.

Based on the research presented in this section, individual-level behaviors of parents and caregivers do not fully explain racial disparities in infant mortality. These racial disparities result from the social conditions facilitated by structural racism and discrimination.

Geography

To calculate statistics by geographic location within the state, counties in Colorado are categorized as urban, rural, or frontier, according to standards applied by the Colorado Rural Health Center.[63] All counties that are not designated as parts of Metropolitan Areas are considered rural. Frontier counties are further classified as those with a population density of six or fewer persons per square mile. It is worth noting that these county designations are limited in that they do not account for the geographic nuance experienced by several large counties in Colorado (e.g., Arapahoe, El Paso, Larimer, Mesa) that have both populous urban centers and broad rural areas.

Between 2015 and 2019, the majority of Colorado residents under age 1 who died by SUID in Colorado resided in an urban county (90.2%, n=202), while 6.7% (n=15) lived in a rural county, and 3.1% (n=7) lived in a frontier county. Although not statistically significant, the rate of

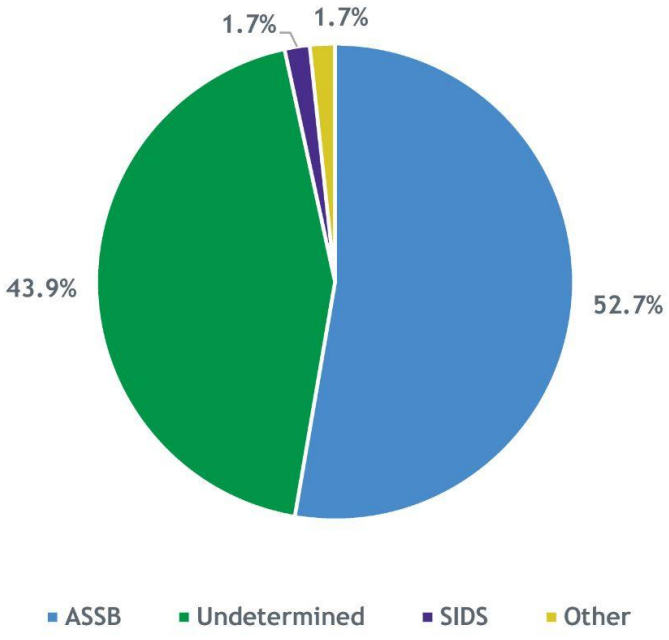
SUID among infants living in a frontier county (109.9 per 100,000 live births) was higher than those living in a rural (50.9 per 100,000 live births) or urban county (70.3 per 100,000 live births). Readers should interpret this data with caution, as the frontier and rural rates represent very few deaths, decreasing the stability of these rates.

This rate data is consistent with national data showing higher SUID rates in rural areas, based on maternal residence as provided on the birth certificate.[64] Research indicates that geographic and social isolation and decreased access to health services experienced by rural communities contributes to higher rates of infant mortality.[65]

SUID Investigative Circumstances

Figure 3 demonstrates the proportion of SUID occurring in Colorado by mechanism of death. Among the 237 SUID identified from 2015-2019, 52.7% (n=125) were attributed to ASSB. Of the remaining mechanisms, 43.9% (n=104) were attributed to undetermined causes and 1.7% (n=4) fell under the criteria for SIDS. The rate of SIDS has decreased since the early 1990s nationally and in Colorado, while the rates of SUID attributed to undetermined causes and ASSB have increased.[66] These changes are driven by improvements in investigations, a more thorough understanding of case definitions, and collecting more detailed information about safe sleep circumstances.

Figure 3. SUID occurring in Colorado by cause category, 2015-2019 (n=237)

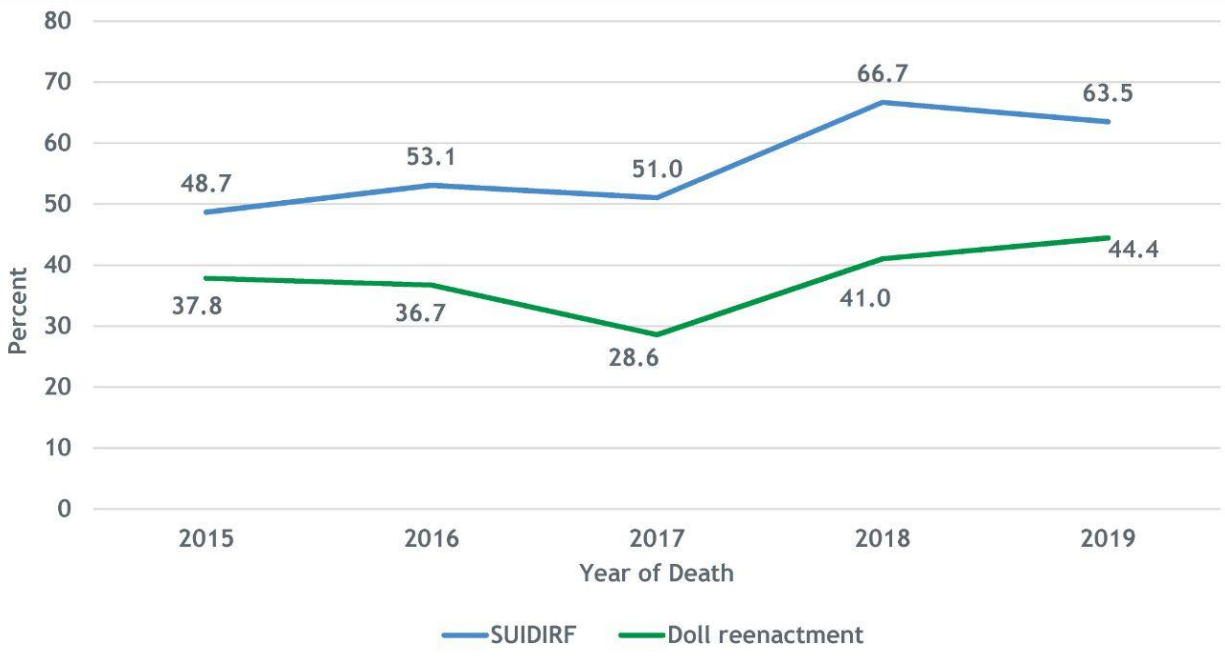


CFPS has limited ability to determine the circumstances related to infant deaths when death scene investigators do not conduct a full investigation. Infant death scene investigations are critical to a comprehensive understanding of the circumstances and factors contributing to unexplained infant deaths. In 1996, the CDC developed the Sudden Unexplained Infant Death Investigation Reporting Form (SUIDIRF) (www.cdc.gov/sids/SUIDRF.htm) to aid in the investigation and understanding of SUID.[67]

From 2015 to 2019, 93.3% (n=221) of all SUID in Colorado had a death scene investigation. The SUIDIRF was used in 57.0% (n=135) of investigations and 38.0% (n=90) of investigations included a scene reenactment with a doll. Figure 4 demonstrates an increasing use of the SUIDIRF and doll reenactments as part of death scene investigations for SUID in Colorado. This suggests that scene investigators have an increased awareness of the importance of these tools in understanding the circumstances of these deaths.

The CFPS 2021 Legislative Report includes a recommendation to encourage and incentivize law enforcement agencies and coroner offices to use the SUIDIRF during infant death scene investigations. This will ensure that law enforcement officers and coroner investigators consistently collect circumstance data when investigating a suspected SUID.

Figure 4. SUID occurring in Colorado by selected investigative methods and year, 2015-2019 (n=237)



Conclusion

SUID is a leading cause of infant mortality in the United States. From 2015 to 2019, SUID accounted for 14.3% of all infant deaths (under age 1) in Colorado. The highest SUID rates were observed among non-Hispanic Black and non-Hispanic AI/AN infants. The majority of SUID during this time period were due to accidental suffocation and strangulation in bed (ASSB) and undetermined causes. Additionally, none of the infants who died between 2015 and 2019 slept in a space that met all of the AAP's Level A Recommendations for a safe infant sleeping environment. Upstream prevention strategies that address social and structural inequities can reduce SUID. To learn more about the prevention strategies recommended by CFPS, view the 2021 Legislative Report (www.cochildfatalityprevention.com/p/reports.html). To learn even more about the inequities that contribute to child deaths, view the CFPS report "*The Role of Policies and Systems in Child Deaths in Colorado*."

For more information and CFPS data, please contact the CFPS Support Team at the Colorado Department of Public Health and Environment:
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