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## U-Shaped Pillows and Sleep-Related Infant Deaths, United States, 2004–2015

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### Abstract

**Objectives**—To describe infant deaths where a u-shaped pillow was under or around an infant and to describe cases classified as *Explained Suffocation*.

**Methods**—We examined demographics and circumstances of 141 infant deaths during 2004–2015 in the US National Fatality Review Case Reporting System with u-shaped pillows in the sleep environment.

**Results**—Most infants were < 6 months old (92%), male (58%), non-Hispanic White (53%), and of the nine explained suffocation deaths, four occurred when the u-shaped pillow obstructed the infant’s airway; five occurred when the infant rolled off the pillow and their airway was obstructed by another object.

**Conclusions for Practice**—Although infrequent, infant deaths with u-shaped pillows have occurred. Health care providers may include discussion of the importance of caregivers following infant product packaging precautions and warning labels for commonly used consumer products, such as u-shaped pillows in their advice to caregivers.

### Keywords

SIDS: sudden infant death syndrome; SUID: sudden unexpected infant death; NFR-CRS: National Fatality Review Case Reporting System; Suffocation

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## Introduction

Sudden infant death syndrome (SIDS) and accidental suffocation and strangulation in bed (ASSB) are among the most prevalent causes of US infant death (Centers for Disease Control and Prevention, National Center for Health Statistics, and National Vital Statistics System 1999–2015). These two causes of death, combined with unknown cause, are part of a larger grouping called sudden unexpected infant death (SUID) (Matthews and MacDorman 2013) or sleep-related infant death (Moon 2011). Studies show that infants placed to sleep with soft bedding, such as pillows and blankets, have an increased likelihood (adjusted OR 2.3–5.1) of dying of SIDS (Hauck et al. 2003; Mitchell et al. 1996). Furthermore, soft objects in the sleep environment can occlude an infant's airway leading to accidental suffocation (Kemp et al. 1994; Scheers et al. 1998).

Because of the association between soft bedding and risk of sleep-related infant death, the American Academy of Pediatrics (AAP) recommends parents and caregivers avoid using soft objects in infant sleep environments (Moon and Task Force On Sudden Infant Death 2016). Despite this recommendation, first published in 1999, soft bedding use in the infant sleep environment continues. A US survey of nighttime caregivers of infants < 8 months old found that more than half of caregivers (55%) placed their infant to sleep with soft bedding (e.g., blankets, pillows, and soft objects) during 2008–2010 (Shapiro-Mendoza et al. 2015). A 2016 multistate survey of mothers 2–6 months postpartum found that 42% of mothers reported using soft bedding in infant sleep environments (Hirai et al. 2019). Since 1999, only small declines in sleep-related infant deaths have occurred, with increasing proportions of deaths being classified as sleep-related accidental suffocation (Erck Lambert et al. 2018).

Because soft objects in the infant sleep environment can result in accidental suffocation, identifying soft object sources that could lead to potentially hazardous situations is important. In Australia, reports of accidental asphyxiation deaths, resulting from U-shaped pillows in the sleep environment, have been documented (Byard and Beal 1997). U-shaped pillows are marketed to support infant positioning during breast and bottle feeding and to prop older infants for supervised sitting and tummy time. When seated, caregivers can wrap the pillow around their waist for support while feeding their infant. For older infants, manufacturer-suggested uses include placing the pillow under the infant to support the head and neck during tummy time or behind infants' lower back when they are learning to sit up. Warning labels on products, packaging materials, and product websites state that u-shaped pillows should always be used under adult supervision and should not be used for sleeping. In this study, we describe characteristics of sleep-related infant deaths where a u-shaped pillow (a type of soft bedding) was under or around an infant at the time of death. In addition, we describe nine cases classified as *Explained Suffocation with Unsafe Sleep Factors* (Shapiro-Mendoza et al. 2014).

## Methods

We used 2004–2015 data from the National Fatality Review Case Reporting System (NFR-CRS) (The National Center for Child Death Review 2018). The NFR-CRS is a nation-wide, web-based system used by US child death review teams to capture detailed information

about child deaths. The objectives, development, features, and limitations of the NFR-CRS have been described elsewhere (Covington 2011). Briefly, child death review teams compile information from multiple data sources including death certificates, autopsy reports, law enforcement records, child protective services records, medical records, and photographs/reports from doll scene reenactments. With this information, these multidisciplinary teams review and discuss the circumstances surrounding a child's death, summarize review findings, formulate prevention recommendations, and enter the information into the NFR-CRS. Access to this multi-source data allows for detailed examination of items found in infant sleep environments, including u-shaped pillows.

For this analysis, eligible cases included those indicated in the NFR-CRS as sleep-related infant (< 365 days old) deaths with u-shaped pillows in the sleep environment. NFR-CRS data fields used to identify cases included: incident sleep place, objects in child's sleep environment, child's location was a new or different environment, death was a consequence of a consumer product, factors that directly contributed to death, modifiable factors that directly contributed to death, and the accompanying narrative. Search terms describing u-shaped pillows included: breastfeeding, u-shaped, nursing, horseshoe, doughnut, as well as product names for u-shaped pillows sold commercially. A copy of the report form and data dictionary is available at [www.ncfrp.org/resources/national-cdr-case-reporting-system/](http://www.ncfrp.org/resources/national-cdr-case-reporting-system/).

Of the 51,141 infant deaths in the NFR-CRS, we identified 178 cases from 11 states with u-shaped pillows in the sleep environment (Fig. 1). All 11 states gave permission to use their de-identified data. We excluded seven cases: three due to medical causes of death that were not related to sleep or the sleep environment, two that were incorrectly selected due to mention of a pillow-like product but not a u-shaped pillow, and two that had a u-shaped pillow in the room but not in the infant's sleep environment. Of the remaining 171 cases, each was further reviewed to determine the position of the pillow in relation to the infant and how it was being used in the sleep environment. Cases were then grouped into three categories: (1) pillow in the sleep environment, but not touching infant when placed to sleep or when found, (2) pillow around infant's head when placed to sleep, or (3) infant placed to sleep on top of the pillow.

Cases in which the pillow was in the sleep environment only and not touching the infant when placed or found (n = 30) are not described further. We calculated frequencies and percentages of selected characteristics (e.g., sleep environment, position found, and obstruction of airway when found) for the infants who were placed to sleep on top of a u-shaped pillow or with a u-shaped pillow around their head. Additionally, we classified the 141 cases using the Centers for Disease Control and Prevention's (CDC) Sudden Unexpected Infant Death (SUID) Case Registry classification system (Shapiro-Mendoza et al. 2014). Of the 141 cases, nine were classified as *Explained Suffocation with Unsafe Sleep Factors* and 132 cases were classified in an unexplained category. We summarize the circumstances of the *Explained Suffocation with Unsafe Sleep Factors* deaths in greater detail. *Explained Suffocation with Unsafe Sleep Factors* cases were those with a complete death investigation documenting where and how the infant was found, a comprehensive autopsy, including, at a minimum, toxicology, imaging and pathology, and a reliable and non-conflicting witnessed account of a full external airway obstruction of both the nose and

mouth, or airway obstruction due to compression of the neck and/or chest (Shapiro-Mendoza et al. 2014). The circumstances for those deaths classified in an unexplained category were not further described because we could not determine why the infant died based upon the available evidence.

## Results

Of the 171 infants found with a u-shaped pillow in the sleep environment, 141 (82%) had been placed to sleep on top of the pillow (n = 139) or with the pillow around their head (n = 2) (Fig. 1). Among these 141 deaths, 92% were < 6 months old, 58% were male, 53% were non-Hispanic White, 34% were born preterm (< 37 weeks), and 47% had Medicaid coverage (Table 1). Infants resulting from twin gestation accounted for 8% of the cases; there were no higher-order multiples or incidents in which both twins died. Over one-third of infants (37%) were reported as having ever been breastfed. Five infants reportedly died after a caregiver fell asleep while breast or bottle feeding (data not shown). Additional unsafe sleep factors were identified in 140 of 141 deaths: 28% (n = 39) were placed to sleep non-supine (on side or prone), 52% (n = 74) were found non-supine, 48% (n = 68) were found on a surface other than a crib, portable crib or bassinet, and 43% were sharing a sleep surface with another person (Table 2).

Among the nine infants classified as *Explained Suffocation with Unsafe Sleep Factors*, all were placed to sleep on top of a u-shaped pillow and were found with their airways fully obstructed. Five infants were placed on their backs, three on their sides, and one was placed prone. All infants either rolled off the pillow or shifted positions from where they had been placed on the pillow. The age at death for infants classified as *Explained Suffocation* ranged from 1 to 6 months (Table 3). Four were described as having the u-shaped pillow fully obstructing their airway and five were described as having their airway obstructed by another soft object (e.g., pillow, blanket, or mattress) after rolling off the u-shaped pillow. One infant was reportedly placed on the u-shaped pillow because of reflux. Two infants were sharing a sleep surface with their mother and other children, and one was sharing with mother only.

## Discussion

Soft objects and loose bedding, including u-shaped pillows, in an infant's sleep environment is an established risk factor for SIDS and a mechanism for sleep-related suffocation (Hauck et al. 2003). This study reviewed deaths where infants were placed to sleep on top of u-shaped pillows or where u-shaped pillows were placed around infants' heads. Also nine suffocation cases where u-shaped pillows were implicated in the death were described in more detail. While infrequent, we identified 141 cases over 12 years where a u-shaped pillow was in the sleep environment at the time of death. Most infants were < 6 months old and non-Hispanic White. Slightly less than half had Medicaid insurance. Importantly, all but 1 of the 141 infants had at least one additional unsafe sleep factor, including side or prone positioning, not sleeping in a crib, bassinet or portable crib, sleeping on a shared surface, and having other soft objects and loose bedding in the sleep environment. Nearly two-thirds were not sleeping in a crib or bassinet, and almost half were bedsharing. In nine cases

for which complete information was available, the placement of the infant on the u-shaped pillow led to an airway obstruction resulting in suffocation.

Although our study lacked a comparison group to estimate SUID risk associated with u-shaped pillow use, we observed some demographic differences between our cases and US SUID over the same period [United States Department of Health and Human Services (US DHHS), Centers of Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), and Division of Vital Statistics (DVS) 2003-2006]. For example, twin births represented 8% of cases in our study population, but only 5% of the full US SUID population. Additionally, our study population was comprised of a higher proportion of infants born preterm (< 37 weeks) than the overall US SUID population, 34% versus 24% (United States Department of Health and Human Services, Centers of Disease Control and Prevention, National Center for Health Statistics, and Division of Vital Statistics 2007-2015). Infants born at preterm have higher infant morbidity and mortality risk than infants born at term (Institute of Medicine (US) Committee on Understanding Premature Birth and Assuring Healthy Outcomes and Behrman RE 2007). This higher risk may be attributed to less mature respiratory systems (Ostfeld et al. 2017), increased susceptibility to respiratory infections (Townsi et al. 2018), delayed arousal response together with reduced ventilator response when exposed to mild hypoxia (Verbeek et al. 2008) and decreased head and neck control (Thach and Stark 1979) in infants born preterm compared to at term. Additionally, infants born preterm are more likely to be diagnosed with gastroesophageal reflux than infants born at term (Eichenwald 2018). It may be that parents of infants born preterm were instructed to elevate the infant's head as a measure to reduce reflux despite recommendations to place infants supine and flat (Moon and Task Force on Sudden Infant Death 2016; Rosen et al. 2018). In our analysis, we found one suffocation death where the infant was reported to have been placed on the pillow to reduce reflux. Further investigation should consider whether u-shaped pillows are more likely to be used with infants born preterm or multiples, or whether their use differs by socio-economic characteristics.

The AAP recommends against the use of sleep positioners and soft bedding such as blankets and pillows, including u-shaped pillows, in infant sleep environments, because these soft items could increase the risk of SIDS and accidental suffocation (Moon and Task Force on Sudden Infant Death 2016). Nevertheless, we documented 171 cases where a u-shaped pillow was used in the sleep environment, which is inconsistent with AAP recommendations and product warning materials. U-shaped pillows are designed and marketed to assist with positioning or propping older infants while awake, or to provide support for the caregiver during breast or bottle feeding. No cases were documented where a caregiver propped an awake infant on a u-shaped pillow and the infant subsequently fell asleep in that position and died. Furthermore, we only documented five cases where the caregiver was using the u-shaped pillow to support breast or bottle feeding before death, and only one-third of the 141 infants were reported as having ever been breastfed. Breast-feeding is associated with a decreased risk of sudden infant death syndrome (Thompson et al. 2017).

Our study had a few limitations. Child death review is a largely voluntary system and completeness of data elements in NFR-CRS varies across states/jurisdictions, especially in states/jurisdictions not participating in the CDC's SUID Case Registry. CDC's SUID

Case Registry is a population based multi-jurisdiction surveillance system which improves the quality, timeliness, and usefulness of SUID data (Kassa et al. 2018; Lagon et al. 2018). For example, additional cases with more complete information about an infant's face and neck position when found may have resulted in an improved understanding of the detailed circumstances of these deaths. Additionally, reporting bias is a concern. For example, it is possible that there were cases where a u-shaped pillow was in an infant's sleep environment, but the child death review committee or death investigator deemed its presence inconsequential, and, as a result, omitted it from the NFR-CRS. This could have resulted in underrepresentation of u-shaped pillows present in infant sleep environments. Also, the NFR-CRS does not systematically capture standardized information about why caregivers use soft bedding in infant sleep environments or more detailed information about regular sleep practices. Finally, since only 11 states were included in this analysis the findings may not be generalizable beyond those states.

Continued surveillance is needed to monitor trends in SUID and infant sleep practices and to identify high risk groups. In addition, qualitative studies such as focus group research may help understand the reasons for caregivers' decisions about infant sleep environment choices and potential barriers to following product warnings and AAP recommendations. Another important research area is improving understanding of how to impact modifiable risk factors. With increased knowledge about caregiver infant care practices and barriers to following product warnings and AAP guidelines, we can develop effective messages (including warning labels about hazardous practices) and interventions.

## Conclusion

Although infrequent, despite product warnings and safe sleep recommendations, infant deaths have occurred with infants placed on u-shaped pillows or with the u-shaped pillows around their heads. Health care providers may wish to educate parents and other caregivers about the AAP infant safe sleep recommendations to reduce the risk of sleep-related infant deaths. They may wish to include discussion of the appropriate use of u-shaped pillows in their advice to caregivers about creating safe sleep environments and following all of the AAP guidelines (Moon and Task Force on Sudden Infant Death 2016). Caregivers of younger infants and infants born preterm might particularly benefit from targeted messaging. A better understanding of the detailed circumstances of infant deaths continues to provide the information necessary to deliver targeted and potentially life-saving safe sleep recommendations. The safest place for an infant to sleep is on their back. Infants should sleep on a firm, flat sleep surface such as a safety-approved crib. Soft objects (such as u-shaped pillows) and loose bedding should be avoided in the sleep environment.

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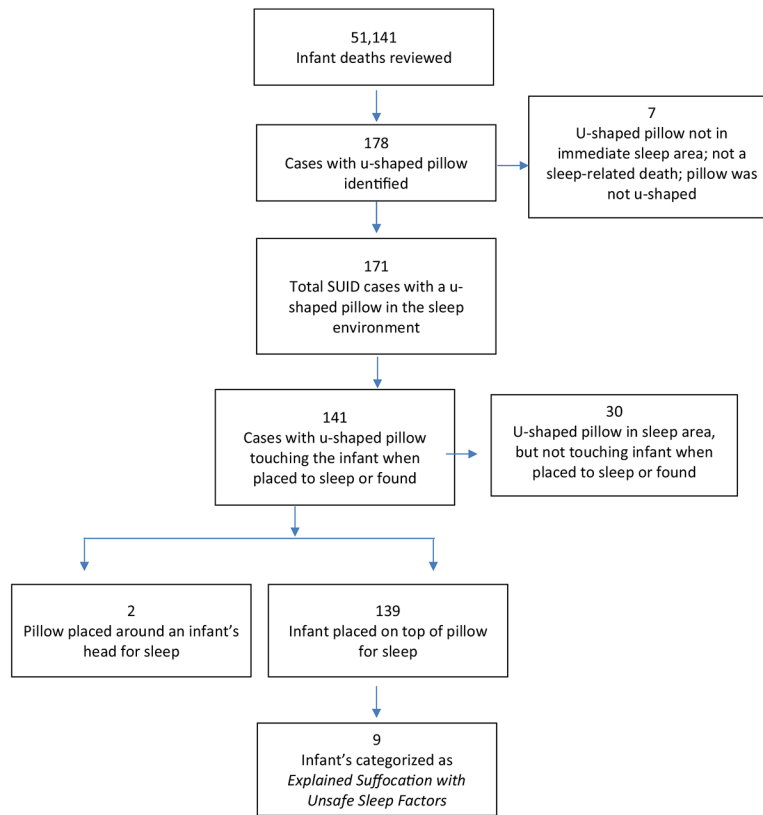
### Significance

**What is already known on this subject?**

There is an association between soft bedding and risk of sleep-related infant death. Despite recommendations from the American Academy of Pediatrics, the use of soft bedding, including pillows, continues.

**What this study adds?**

Although infrequent, infant deaths have occurred with u-shaped pillows in the sleep environment. In nine cases, the u-shaped pillow directly contributed to the infants' airway obstruction.



**Fig. 1.** Study population of infant deaths derived from the National Fatality Review Case Reporting System during 2004–2015

**Table 1**

Demographics of infants placed to sleep on a u-shaped pillow or with a u-shaped pillow around their head, 2004–2015 (n = 141)

	Frequency	Percent <sup>a</sup>
Age in months		
0	21	14.9
1	19	13.5
2	31	22.0
3	24	17.0
4	18	12.8
5	16	11.4
6	6	4.3
7	6	4.3
Sex		
Male	82	58.2
Female	59	41.8
Race/ethnicity		
Non-Hispanic White	75	53.2
Non-Hispanic Black	37	26.2
Hispanic	16	11.4
Other	6	4.3
Unknown	7	5.0
Gestational age at birth		
Term (≥ 37 weeks)	93	66.0
Preterm (< 37 weeks)	48	34.0
Plurality		
Singleton	127	90.1
Twin	11	7.8
Unknown	3	2.1
Insurance at birth <sup>b</sup>		
Medicaid	66	46.8
Private	21	14.9
State plan/other	11	7.8
None/unknown	43	30.5

<sup>a</sup>Percentages may not add to 100% due to rounding

<sup>b</sup>“State Plan” is defined in the NFR-CRS Data Dictionary as family’s medical care being paid for by any type of state-sponsored plan except Medicaid, and “Other” is defined as family’s medical care paid for by any other type of support excluding self-support

**Table 2**

Characteristics of infants placed to sleep on a u-shaped pillow or with a u-shaped pillow around their head, 2004–2015 (n = 141)

	Frequency	Percent <sup>a</sup>
Position placed to sleep		
Back	83	58.9
Side	23	16.3
Prone	16	11.4
Unknown	19	13.5
Position found		
Back	45	31.9
Side	17	12.1
Prone	57	40.4
Unknown	22	15.6
Incident sleep place		
Crib/bassinet	52	36.9
Adult bed	54	38.3
Chair/couch	14	9.9
Unknown	21	14.9
Infant ever breastfed		
Yes	52	36.9
No/unknown	89	63.1
Sharing a sleep surface		
Yes	60	42.6
No	64	45.4
Unknown	17	12.1

<sup>a</sup>Percentages may not add to 100% due to rounding

Summary of the nine cases categorized as *Explained Suffocation with Unsafe Sleep Factors* where infant was placed on a u-shaped pillow and it contributed to suffocation, 2004–2015

**Table 3**

Age at death (months)	Sex	Gestational age at birth (weeks)	Incident sleep place	Object obstructing the infant's airway	Description
1	Female	37	Adult bed	U-shaped pillow	Infant placed supine on u-shaped pillow. Found on side, still on u-shaped pillow with face pressed into pillow. Infant was sharing bed with mother and 2 other children
3	Male	39	Crib	U-shaped pillow	Infant was placed on side on the middle of u-shaped pillow. Found face down on u-shaped pillow
4	Male	39	Crib	U-shaped pillow	Infant was placed on side on u-shaped pillow. Found 11 h later prone with face into pillow
4	Male	40	Adult bed	U-shaped pillow	Infant placed prone on u-shaped pillow. Found prone with face into pillow and a blanket covering head. Infant sharing bed with mother and 4 other children
1	Male	39	Floor	Pile of blankets	Infant placed supine on edges of u-shaped pillow which was placed on a pile of blankets. Found prone with u-shaped pillow around his head and his face in the center obstructed by the blankets
1	Female	35	Adult bed	Adult mattress	Infant placed on side on u-shaped pillow. Found prone with face down into the mattress and a pillow covering head. Infant was sharing the bed with mother
2	Female	36	Crib	Bumper pad	Infant placed supine on u-shaped pillow. Found prone with face pressing into bumper pad. Infant sharing crib with twin who was on a second u-shaped pillow
3	Male	34	Crib	Blankets	Infant placed supine on u-shaped pillow; position was reportedly based on provider advice because of reflux. Found with face pressed into blankets
6	Female	39	Couch	Basket of clothes	Infant placed supine on u-shaped pillow on couch. Found with head and face in a basket of clothing next to the couch with legs still on the couch

Cases categorized as *Explained Suffocation with Unsafe Sleep Factors* had to have a complete death investigation documenting where and how the infant was found, a comprehensive autopsy, including, at a minimum, toxicology, imaging and pathology, and a reliable and non-conflicting witnessed account of a full external airway obstruction of both the nose and mouth, or airway obstruction due to compression of the neck and/or chest