Trends in the Incidence of Sudden Unexpected Infant Death in the Newborn: 1995-2014

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Objective To evaluate the epidemiology of sudden unexpected infant death (SUID) over a 20-year period in the US, to assess the potential frequency of sudden unexpected postnatal collapse in the early days of life, and to determine if SUID rates in the neonatal period (0-27 days) have changed in parallel with rates in the postneonatal periods, including the percentages attributed to codes that include accidental suffocation.

Study design Data from the US Centers for Disease Control and Prevention Linked Birth/Infant Death Records for 1995-2014 were analyzed for the first hour, day, week, and month of life. A comparison of neonatal and postneonatal data related to SUID, including accidental suffocation, was carried out.

Results Death records for 1995-2014 indicate that, although SUID rates in the postneonatal period have declined subsequent to the 1992 American Academy of Pediatrics sleep position policy change, newborn SUIDs have failed to decrease, and the percentage of SUIDs attributed to unsafe sleep conditions has increased significantly in both periods; 29.2% of the neonatal cases occurred within the first 6 days of life.

Conclusions The frequency of SUIDs during the neonatal period warrants ongoing attention to all circumstances contributing to this category of deaths. The development of a standardized definition of sudden unexpected postnatal collapse and a national registry of these events is recommended. Ongoing research on the effects of early neonatal practices on postneonatal SUID should also be encouraged. *(J Pediatr 2017;■■:■■-■■).*

The US Centers for Disease Control and Prevention (CDC) define sudden unexpected infant death (SUID) as "the death of an infant less than 1 year of age that occurs suddenly and unexpectedly, and whose cause of death is not immediately obvious before investigation."[1] A similar acronym that is often used is "SUDI," for "sudden unexpected death in infants."[2] The definition of SUID includes sudden infant death syndrome (SIDS), as well as accidental suffocation and strangulation in bed (ASSB) and unknown causes of death in infants less than 1 year of age.[1] Although the rate of SIDS peaks between 1 and 4 months of age, newborns are also vulnerable.[3]

Sudden unexpected postnatal collapse (SUPC) describes healthy infants born at greater than 35 weeks of gestation age, with a 10-minute Apgar score of greater than 7, who collapse suddenly and unexpectedly within the first postnatal week of life.[4] Although not an official category in the *International Classification of Diseases* (ICD), newborn deaths after SUPC conform to the CDC definition of SUID.

After the implementation of the American Academy of Pediatrics (AAP) sleep position policy change in 1992,[5] a 25% increase in the proportion of SIDS deaths occurring in the first month of life was reported.[6] The authors suggested that some cases previously reported as SIDS are now classified in other SUID categories, including ASSB and unknown causes, a trend also noted by the AAP.[7] To account for that possibility, we examined the incidence of SUID in the US, which encompasses all categories of sudden unexpected deaths in infancy, including SIDS, SUPC, and ASSB. The purpose of our report is to focus on the details of the evolving pattern of newborn SUID, including data on the early days of life that may reflect SUPC deaths.

Methods

The US National Vital Statistics System category of SUID[8] combines conditions included in ICD-9 (1995-1998) and ICD-10 (1999-2014) codes 798.0, R95 (SIDS); E913.0,W75 Mechanical Suffocation Bed or Cradle (MSBC), Accidental Suffocation and

AAP	American Academy of Pediatrics
ASSB	Accidental suffocation and strangulation in bed
CDC	Centers for Disease Control and Prevention
ICD	*International Classification of Diseases*
MSBC	Mechanical Suffocation Bed or Cradle
SIDS	Sudden infant death syndrome
SSC	Skin-to-skin care
SUID	Sudden unexpected infant death
SUPC	Sudden unexpected postnatal collapse

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Strangulation in Bed (ASSB); and 799.9, R99 (Unspecified). We applied these codes to national data from the Linked Birth/Infant Death Records for the most recent 20-year period available on the CDC WONDER On-Line Database for both the neonatal period (<28 days) and the postneonatal period (28-364 days).[9] Annual total SUID incidence rates per 100 000 births for 1995-2014 and percent of total SUIDs potentially related to unsafe sleep related circumstances MSBC and ASSB were identified separately for the neonatal and postneonatal periods. In addition, to gauge the potential impact of SUPC during the neonatal period, the number of deaths in the first hour, hours 1-23, and days 1-6 of life were also compiled, and a frequency distribution of average annual occurrences was developed. The percentage of cases in 2 gestational age groups (>35 weeks and ≤35 weeks) was also collected.

A logistic regression model was performed to evaluate the risk of SUID attributable to MSBC/ASSB associated with time period (2014 vs 1995) and neonatal population (neonatal vs postneonatal). Statistical analysis was performed using SAS v9.4 (Cary, North Carolina) and a type I error rate of 0.05. An exploratory interaction term was included to test whether the change in risk over time differed by neonatal status.

Results

From 1995 to 2014, 8869 SUIDs occurred in the first month of life in the US, including 2593 (29.2%) in the first 6 days, 1317 (14.8%) on the first day, and 625 (7%) in the first hour of life. The frequency distribution of average annual rates by time interval is presented in **Figure 1**. Neonates greater than 35 weeks of gestation accounted for 60.1% of the SUIDs in the first 6 days of life, of which there were 511 with SIDS codes (798/R95). The remaining 39.9% were 35 weeks of gestation or less, including 64 with SIDS codes.

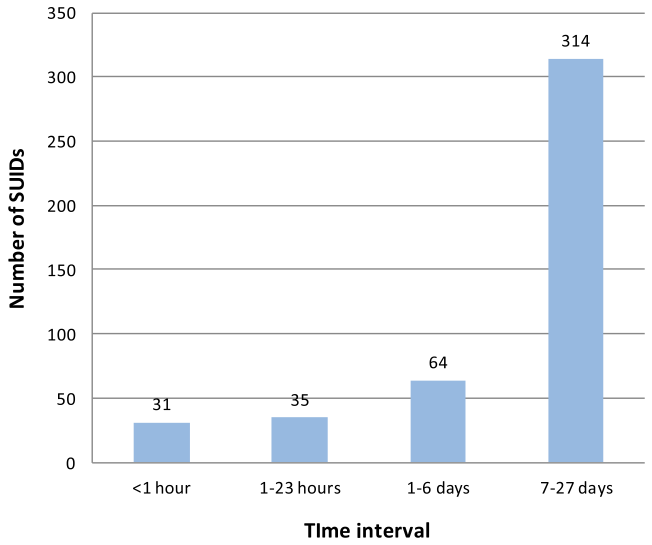

Figure 1. US average annual neonatal SUIDs, 1995-2014. (Source: CDC WONDER Linked Birth/Infant Death Records.)

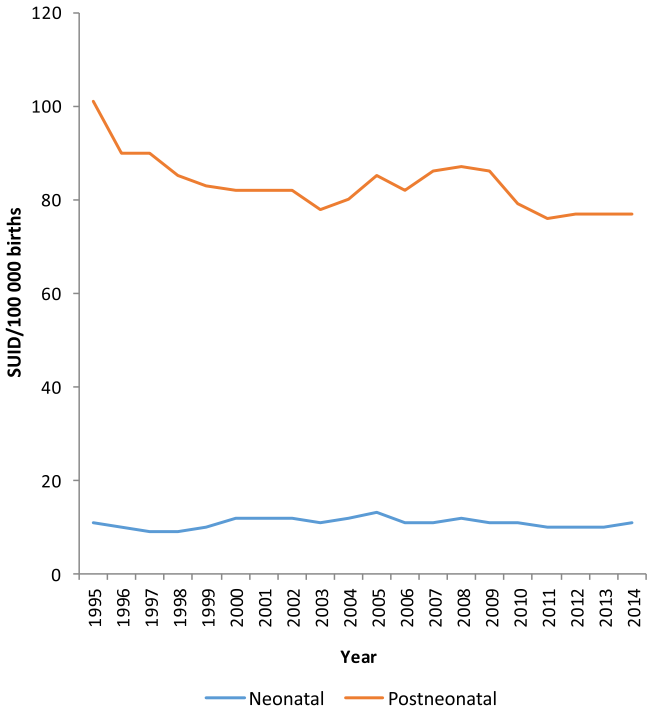

Figure 2. US postneonatal/neonatal SUID rates per 100 000 births, 1995-2014. (Source: CDC WONDER Linked Birth/Infant Death Records.)

During the same time period, rates of postneonatal (28-364 days) SUID decreased by 22.7%, from 101 in 100 000 births in 1995 to 78 in 100 000 births in 2002, after which rates did not show continuing decline, while rates of neonatal (<28 days) SUID in 1995 and 2014 remained stable at 11 in 100 000 births (**Figure 2**). The percentage of SUID attributed to the neonatal period increased from 9%-10% in 1995 to 1998 to 11%-13% from 1999 to 2014 (**Figure 3**).

The percentage of SUIDs attributed to MSBC/ASSB increased over time in both the neonatal and postneonatal populations, from 2.1% in the neonatal population and 3.4% in the postneonatal population in 1995, to 22.7% and 24.9%, respectively, in 2014, representing an 11-fold proportionate increase in the neonatal population and a 7-fold proportionate increase in the postneonatal population. Neonatal increases exceeded postneonatal increases in 13 of the 20 years. SUIDs attributable to MSBC/ASSB were significantly higher in 2014 compared with 1995 ($P < .0001$; OR 9.7; 95% CI 8.1-11.7). SUIDs attributable to MSBC/ASSB did not differ significantly between postneonatal and neonatal populations ($P = .14$; OR 1.2; 95% CI 0.9-1.5).

Discussion

This analysis documents the extent of SUID in the first day, week, and month of life, and shows that the decrease in the incidence of postneonatal SUID concurrent with implementation of the Back to Sleep Campaign in the mid-1990s did

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