Characteristics of Sudden Unexpected Infant Deaths on Shared and Nonshared Sleep Surfaces

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abstract

OBJECTIVES: Describe characteristics of sudden unexpected infant deaths (SUID) occurring on shared or nonshared sleep surfaces.

METHODS: We examined SUID among residents of 23 US jurisdictions who died during 2011 to 2020. We calculated frequencies and percentages of demographic, sleep environment, and other characteristics by sleep surface sharing status and reported differences of at least 5% between surface sharing and nonsharing infants.

RESULTS: Of 7595 SUID cases, 59.5% were sleep surface sharing when they died. Compared with nonsharing infants, sharing infants were more often aged 0 to 3 months, non-Hispanic Black, publicly insured, found supine, found in an adult bed or chair/couch, had a higher number of unsafe sleep factors present, were exposed to maternal cigarette smoking prenatally, were supervised by a parent at the time of death, or had a supervisor who was impaired by drugs or alcohol at the time of death. At least 76% of all SUID had multiple unsafe sleep factors present. Among surface-sharing SUID, most were sharing with adults only (68.2%), in an adult bed (75.9%), and with 1 other person (51.6%). Surface sharing was more common among multiples than singletons.

CONCLUSIONS: Among SUID, surface sharing and nonsharing infants varied by age at death, race and ethnicity, insurance type, presence of unsafe sleep factors, prenatal smoke exposure, and supervisor impairment. Most SUID, regardless of sleep location, had multiple unsafe sleep factors present, demonstrating the need for comprehensive safe sleep counseling for every family at every encounter.

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DOI: https://doi.org/10.1542/peds.2023-061984

Accepted for publication Dec 13, 2023

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

WHAT'S KNOWN ON THIS SUBJECT: Sleep surface sharing, soft bedding, and prone sleep position are risk factors for sudden infant death syndrome and sudden unexpected infant death (SUID). The prevalence of surface sharing ranges from 34% to 64% among living infants and about 50% among SUID.

WHAT THIS STUDY ADDS: Compared with nonsurface sharing infants, infants who shared a surface at the time of death were more often younger, non-Hispanic Black, and publicly insured. However, most SUID, regardless of surface sharing status, were in unsafe sleep environments.

To cite: Erck Lambert AB, Shapiro-Mendoza CK, Parks SE, et al. Characteristics of Sudden Unexpected Infant Deaths on Shared and Nonshared Sleep Surfaces. *Pediatrics.* 2024; 153(3):e2023061984

Sharing a sleep surface with an infant is discouraged because it increases the risk of sleep-related sudden unexpected infant death (SUID), including sudden infant death syndrome (SIDS), accidental suffocation and strangulation in bed, and other ill-defined and unknown causes.[1–6] SUID includes infants <1 year old who die suddenly and unexpectedly without an obvious cause before investigation[7] and accounts for about 3400 deaths annually in the United States.[8] In 2016 to 2017, 37% of US infants surface shared and 54% of infants in the SUID Case Registry were surface sharing at the time of death.[6] Findings from a meta-analysis showed surface sharing was associated with an almost threefold risk of SIDS.[1] Surface sharing is associated with an increased odds for both sleep-related suffocation and unexplained infant death (adjusted odds ratios: 2.5 [95% confidence interval (CI) 1.1–6.0] and 2.1 [95% CI 1.4–3.2] respectively).[6] Surface sharing, especially on a couch or armchair, increases risk of unintentional suffocation by soft bedding, wedging or entrapment, and overlay.[3,9,10] Moreover, surface sharing in combination with parental smoking and maternal alcohol or drug use greatly increases SIDS risk.[11]

In addition to surface sharing, independent risk factors for SIDS and other sleep-related infant deaths include nonsupine sleep position, an inclined or soft sleep surface, sleeping with soft, loose bedding, or objects, not breastfeeding, overheating, and prenatal or environmental exposure to tobacco smoke.[4–6] Among SUID with a complete investigation and documented sleep environment information, 98.5% occur in an unsafe sleep environment[12]; about half of SUID occur on a shared sleep surface.[13,14]

Understanding differences and similarities between SUID occurring on shared and nonshared sleep surfaces may inform safe infant sleep counseling, messaging, and future research. We describe characteristics and circumstances of SUID by surface sharing status, including infant demographics, birth characteristics, sleep environment, other characteristics, and SUID Case Registry Classification System category and suffocation mechanism. In addition, for surface-sharing SUID, we describe found location and person(s) sharing the sleep surface. Finally, because multiple births are overrepresented among SUID,[15] we explore surface sharing and other sleep environment characteristics by plurality.

METHODS

We used data from the Centers for Disease Control and Prevention's SUID Case Registry (the Registry),[16] a multijurisdictional, population-based surveillance system. The Registry builds on existing child death review programs and protocols and has been previously described.[16–18] Briefly, multidisciplinary child death review teams review and compile information on child deaths from multiple sources (eg, death certificates, autopsy reports, medical records) and make prevention recommendations based on their findings. Review information and recommendations are entered into the National Fatality Review-Case Reporting System (NFR-CRS).[17]

We studied 8192 SUID that occurred during 2011 to 2020 among residents of Registry jurisdictions including: Alaska; Arizona; San Francisco County, California; Colorado; Delaware; Georgia; Cook County, Illinois; Indiana; Kentucky; Louisiana; Maryland; Michigan; Minnesota; New Hampshire; New Jersey; New Mexico; Nevada; Pennsylvania; Tennessee; Utah; Tidewater Region of Virginia; Pierce County, Washington; and Wisconsin. SUID included deaths with any of the following causes reported on the death certificate: unknown, undetermined, SIDS, SUID, unintentional sleep-related asphyxia, suffocation, or strangulation, unspecified suffocation, cardiac or respiratory arrest without other well-defined causes, or ill-defined causes with potentially contributing unsafe sleep factors. Intentional homicides were excluded. We defined unsafe sleep as prone or side position, shared sleep surface, sleep surface other than a crib or bassinet, any bedding other than a fitted sheet, or soft objects in the sleep area.[5] We excluded cases that had not undergone Registry data quality control procedures[19] ($n = 153$) and those with missing or unknown information about surface sharing ($n = 444$). After exclusions, 7595 SUID remained.

Infant demographic and birth characteristics included age at death, sex, race and ethnicity, gestational age at birth, insurance type, and plurality. Sleep environment included infant's found position and location, presence of soft bedding (excluding the sleep surface), and number of unsafe sleep factors other than surface sharing (including soft bedding, not in a crib, and non-supine position), and, among surface sharing infants, with whom the infant was surface sharing. Other characteristics included exposure to prenatal maternal cigarette smoking, ever breastfed, primary caregiver a parent, caregiver age, supervisor a parent, supervisor impaired by drugs or alcohol at time of death, open child protective services case for the infant, and having a crib or bassinet in the infant's home. Variables are described in the NFR-CRS data dictionary.[20]

Infants were designated as "sharing" if they were sleeping with another person (ie, infant, child, or adult) or animal on any surface (eg, adult bed, crib, couch) at time of death. The NFR-CRS data dictionary guides child death review team members to ascertain infant race and ethnicity from the death certificate.[20,21] We acknowledge that race and ethnicity are social constructs and not genetic or biological categories.[22,23] We choose to report race and ethnicity because race and racism

are embedded in our culture, societal structures, and systems supporting and affecting families and their understanding and implementation of safe sleep practices. We refer to cribs, bassinets, and portable cribs as "crib." We quantified "unsafe sleep factors other than surface sharing" by combining multiple fields (ie, objects in the child's sleep environment, found location, and found position). Because evidence about the safety of in-bed sleepers is limited, we grouped infants found in portable bassinets placed on an adult bed ($n < 6$) as "adult bed" for found location. Although "fed human milk" is more inclusive, we used "breastfed" for consistency with the NFR-CRS. "Primary caregiver" is the person who had responsibility for the infant's care a majority of the time.[20] "Supervisor" is the person who had responsibility for the infant's care at time of death.[20] "Parent" includes biological, adoptive, or step-parent.

The Registry Classification System category and suffocation mechanism were assigned by trained Registry staff using the SUID Case Registry Classification System and Algorithm.[12,24] We collapsed the categories unexplained-incomplete case information and unexplained-no autopsy or death scene investigation into unexplained-incomplete information.

Among SUID, we calculated frequencies and percentages by surface sharing status for infant demographic and birth characteristics, sleep environment, other characteristics, Registry Classification System category, and, for SUID categorized as explained or possible suffocation, suffocation mechanism. We calculated χ-square tests of independence to determine if each variable was associated with surface sharing status. To limit the chance of erroneous associations, we excluded missing results from the χ-square analyses. Magnitude or direction of associations were not estimated. Most variables were significantly associated with surface sharing status ($P < .05$). In large study populations such as ours, statistical significance can emerge with small quantitative differences, complicating interpretation.[25] Thus, we highlight clinically meaningful differences of at least 5 percentage points between sharing and nonsharing infants. We conducted analyses using SAS 9.3 (SAS Institute, Cary, NC). Each jurisdiction signed a data-use agreement allowing inclusion of de-identified, aggregated data.

RESULTS

Of the 7595 SUID, 59.5% were sleep surface sharing and 40.5% were not at time of death (Table 1).

Infant Demographic and Birth Characteristics

Infants aged 0 to 3 months made up the largest proportion of sharing (73.2%) and nonsharing infants (56.7%) (Table 1); however, a higher proportion of nonsharing infants were 4 to <12 months (43.3%) as compared with sharing infants (26.8%). Sharing infants were most commonly non-Hispanic Black (42.2%) and nonsharing infants were most commonly non-Hispanic white (46.2%). Publicly insured infants made up the largest proportion of sharing (75.1%) and nonsharing infants (64.3%); however, a higher proportion of nonsharing infants were privately insured (19.8%) as compared with sharing infants (11.5%). The differences between sharing and nonsharing infants in the distribution of infant sex, gestational age, and plurality were not clinically meaningful.

Sleep Environment

Sharing infants were most often supine (41.1%) and in an adult bed (75.7%); nonsharing infants were most often prone (49.5%) and in a crib (51.8%) (Table 1). Soft bedding in the sleep environment (excluding sleep surface) was common among sharing (68.3%) and nonsharing infants (73.8%). Sharing infants had a larger number of unsafe sleep factors in addition to surface sharing; specifically, 31.3% of sharing infants had all 3 unsafe sleep factors (soft or loose bedding or objects; not in a crib; prone or side position) as compared with 21.0% of nonsharing infants. At least 76% of SUID, regardless of sleep location, had multiple unsafe sleep factors present.

Other Characteristics

Exposure to prenatal maternal cigarette smoking was more common among sharing (41.4%) than nonsharing infants (30.5%). Being supervised by a parent at time of death was more common among sharing (87.2%) than nonsharing infants (72.5%). Having a supervisor who was impaired by drugs or alcohol was more common among sharing (16.3%) than nonsharing infants (4.7%). Not having a crib in the infant's home was more common among sharing (18.6%) than nonsharing infants (10.2%) (Table 1). The differences between sharing and nonsharing infants in the distribution of ever breastfed, whether the primary caregiver was a parent, caregiver age, and having an open child protective services case were not clinically meaningful.

SUID Case Registry Classification System Category and Suffocation Mechanism

The difference between sharing and nonsharing infants with respect to classification system categories was not clinically meaningful. Among deaths categorized as explained-suffocation, the suffocation mechanism of soft bedding was the most common among sharing (47.7%) and nonsharing infants (80.1%). Of surface sharing infants classified as explained-suffocation, 28.4% were attributed to overlay.

TABLE 1 Infant and Other Characteristics Among Sudden Unexpected Infant Death by Surface Sharing Status, SUID Case Registry, 2011 to 2020					
	Percent Distribution by Surface Sharing Status				
	Sharing		**Nonsharing**		***P*[a]**
	n	%	*n*	%	
Overall	4520	59.5	3075	40.5	
Infant demographic and birth characteristics					
Age in months					<.001
0–3	3307	73.2	1744	56.7	
4–6	903	20.0	940	30.6	
7–<12	310	6.9	391	12.7	
Infant sex					<.001
Male	2536	56.1	1844	60.0	
Female	1983	43.9	1228	39.9	
Infant race and ethnicity					<.001
Non-Hispanic American Indian/Alaska Native	118	2.6	42	1.4	
Non-Hispanic Asian	25	<1	39	1.3	
Non-Hispanic Black	1906	42.2	882	28.7	
Non-Hispanic Native Hawaiian/Pacific Islander	16	<1	6	<1	
Non-Hispanic white	1609	35.6	1422	46.2	
Non-Hispanic multiple	253	5.6	187	6.1	
Hispanic	532	11.8	456	14.8	
Unknown	60	1.3	40	1.3	
Gestational age at birth					.004
Preterm (≤33 wk)	325	7.2	238	7.7	
Late preterm (34–36 wk)	732	16.2	405	13.2	
Term (≥37 wk)	3364	74.4	2358	76.7	
Unknown	77	1.7	54	1.8	
Insurance type					<.001
None	76	1.7	64	2.1	
Private	521	11.5	610	19.8	
Public[b]	3394	75.1	1976	64.3	
Other or combination of public and private	47	1.0	49	1.6	
Unknown	431	9.5	335	10.9	
Plurality					<.001
Multiple birth	365	8.1	134	4.4	
Singleton birth	4113	91.0	2914	94.8	
Unknown	19	<1	7	<1	
Sleep environment					
Infant's found position					<.001
Supine	1858	41.1	1001	32.6	
Prone	1373	30.4	1521	49.5	
Side	729	16.1	373	12.1	
Unknown	507	11.2	158	5.1	
Infant's found location					<.001
Crib, bassinet, or portable crib	94	2.1	1594	51.8	
Adult bed	3422	75.7	678	22.0	
Chair or couch	710	15.7	134	4.4	
Other	284	6.4	654	21.3	
Unknown	10	<1	14	<1	
Soft bedding in sleep environment[c]					<.001
Yes	3089	68.3	2270	73.8	
Not indicated	1431	31.7	805	26.2	

TABLE 1 Continued					
	Percent Distribution by Surface Sharing Status				
	Sharing		**Nonsharing**		***P*[a]**
Number of unsafe sleep factors in addition to surface sharing[d]	*n*	%	*n*	%	<.001
1	811	17.9	822	26.7	
2	2277	50.4	1436	46.7	
3	1414	31.3	647	21.0	
Could not be determined	18	<1	159	5.2	
Other characteristics					
Exposed to maternal cigarette smoking during pregnancy					<.001
Yes	1870	41.4	937	30.5	
No	2296	50.8	1901	61.8	
Unknown	307	6.8	196	6.4	
Ever breastfed					.23
Yes	2425	53.7	1677	54.5	
No	1708	37.8	1110	36.1	
Unknown	347	7.7	259	8.4	
Primary caregiver parent[e]					<.001
Yes	4400	97.3	2920	95.0	
No	112	2.5	149	4.8	
Unknown	—	—	0	0.0	
Caregiver age in years					.06
≤19	425	9.4	267	8.7	
20–24	1416	31.3	922	30.0	
25–34	2052	45.4	1390	45.2	
35+	469	10.4	345	11.2	
Unknown	123	2.7	114	3.7	
Supervisor parent[e]					<.001
Yes	3941	87.2	2228	72.5	
No	331	7.3	666	21.7	
Unknown	—	—	—	—	
Supervisor impaired by drugs or alcohol at the time of the death[f]					<.001
Yes	736	16.3	144	4.7	
Not indicated	3784	83.7	2931	95.3	
Open child protective services case on the child at the time of the death					.005
Yes	485	10.7	329	10.7	
No	3705	82.0	2579	83.9	
Unknown	257	5.7	124	4.0	
Crib or bassinet in the infant's home					<.001
Yes	2561	56.7	2328	75.7	
No	824	18.2	313	10.2	
Unknown	1035	22.9	391	12.7	
SUID case registry classification system category and suffocation mechanism					<.001
Explained-suffocation with unsafe sleep factors	881	19.5	677	22.0	
Soft bedding[g]	420	47.7	542	80.1	
Wedging[g]	34	3.9	37	5.5	
Overlay[g]	250	28.4	—	—	
Other[g] or more than 1 indicated	177	20.1	97	14.3	
Unexplained-possible suffocation with unsafe sleep factors	505	11.2	450	14.6	

TABLE 1 Continued					
	Percent Distribution by Surface Sharing Status				
	Sharing		Nonsharing		*P*[a]
Unexplained-unsafe sleep factors	2047	45.3	1250	40.7	
Unexplained-no unsafe sleep factors	—	—	70	2.3	
Unexplained-incomplete information[h]	1083	24.0	628	20.4	

Cell counts between 0 and 6 are suppressed to maintain confidentiality.
A missing response indicates the question was skipped during data entry. An unknown response indicates the question was considered however the information necessary to answer the question was not available to anyone.[19]
[a] Missing data were excluded from the χ-square analysis. Missing data were <3% for all variables, except for Supervisor Parent (Biological, Adoptive, or Step) with 5% missing data for sharing infants and 6% missing for nonsharing infants.
[b] Includes Medicaid, State Plan, Indian Health Service.
[c] Excludes the sleep surface (including noncrib mattress and cushion when incident sleep place is couch).
[d] Factors include soft bedding; not in a crib, bassinet, or portable crib; and nonsupine position. Zero unsafe sleep factors could not be determined because the soft bedding variable does not distinguish between missing, unknown, and no.
[e] Biological, adoptive, or step.
[f] Assessment of supervisor drug or alcohol impairment status during the death scene investigation is not standard, and a test (eg, blood or breathalyzer) was not required for the supervisor to be documented as impaired.
[g] The mechanisms are defined as follows: soft bedding is when the infant's airway (nose and mouth) are obstructed by a soft item in the immediate sleep environment; wedging is when the infant's airway (nose and mouth, neck or chest) is obstructed as a result of being stuck or trapped between inanimate objects; overlay is when the infant's airway (nose and mouth, neck or chest) is obstructed by a person on top of or against the infant; other is when the infant's airway is obstructed by something in the sleep environment other than soft bedding, overlay, or wedging (like a plastic bag).
[h] Unexplained-incomplete case information and unexplained-no autopsy or death scene investigation categories are collapsed into unexplained-incomplete information.

Surface Sharing Location and Type of Person Sharing

Among surface-sharing SUID, 69.4% were sharing with 1 or more adult only, 21.9% with adults and other children, and 7.6% with other children only (Table 2). Among infants sharing with adults only, 75.2% were in an adult bed and 18.7% were on a couch or chair. Among infants sharing with other children only, 47.3% were in an adult bed, 26.9% were in a crib, and 13.0% were on a couch or chair. Among surface-sharing SUID, 51.6% were sharing with 1 other person, 34.9% with 2 other people, and 10.7% with ≥3 other people (not in table).

Surface Sharing Characteristics Among Surface Sharing infants by Plurality

When comparing sharing and nonsharing infants, the difference in the plurality distribution was not clinically meaningful, however we found larger differences when comparing characteristics by plurality. Surface sharing was more common among multiples; of 499 multiples, 365 (73.1%) were surface sharing, and of 7027 singletons, 4113 (58.5%) were surface sharing (Table 1). Among surface-sharing SUID, multiples were sharing with adults only (23.8%), other children only (34.5%), or adults and other children (38.4%) (Table 3). Surface-sharing singletons were sharing with adults only (72.0%), other children only (5.1%), or adults and other children (20.1%). Infants found in an adult bed made up the largest proportion of surface-sharing multiples (61.1%) and surface-sharing singletons (77.0%). Being found in a crib was more common among surface-sharing multiples (22.2%) than surface-sharing singletons (<1% [n = 13]). The largest proportion of surface-sharing multiples were prone (38.9%), whereas the largest proportion of surface-sharing singletons were

TABLE 2 Found Location and Person(s) Sharing the Sleep Surface Among Surface Sharing Sudden Unexpected Infant Deaths, SUID Case Registry, 2011 to 2020

			Person(s) Sharing Sleep Surface with Infant							
	Total		Adults Only		Children Only		Adults and Children		Other Combinations of Adults, Children, and Pets[a]	
Found location	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Crib, bassinette or portable crib	94	2.1	—	—	91	26.9	—	—	—	—
Adult bed	3355	75.8	2312	75.2	160	47.3	845	86.9	38	86.4
Couch or chair	697	15.7	576	18.7	44	13.0	72	7.4	5	11.4
Other	283	6.4	—	—	43	12.7	55	5.7	—	—
Overall total	4429	—	3075	69.4	338	7.6	972	21.9	44	1.0

Select cells are suppressed to maintain confidentiality.
Two percent of total cases have missing or unknown information for incident sleep place and/or type of person sharing a sleep surface and were removed from this table.
A missing response indicates the question was skipped during data entry. An unknown response indicates the question was considered however the information necessary to answer the question was not available to anyone.[19]
Adults include infants who were sharing with 1 or more adults; children include infants who were sharing with 1 or more other children.
[a] Equal to or less than 6 infants were surface sharing with just a pet.

TABLE 3 Surface Sharing Characteristics Among Surface Sharing Sudden Expected Infant Deaths by Plurality, SUID Case Registry, 2011 to 2020					
	Multiple		Singleton		*P*[a]
	n	%	*n*	%	
Overall	365	8.2	4113	91.8	
Sharing with[b]					<.001
Adults only	87	23.8	2961	72.0	
Children only	126	34.5	209	5.1	
Adults and children	140	38.4	828	20.1	
Some combination of adults, children, and pets[c]	—	—	40	1.0	
Found sleep location					<.001
Crib, bassinet, or portable crib	81	22.2	13	<1	
Adult bed	223	61.1	3166	77.0	
Chair or couch	36	9.9	670	16.3	
Other[d]	23	6.3	257	6.2	
Unknown	—	—	7	<1	
Found position					.001
Supine	128	35.1	1720	41.8	
Prone	142	38.9	1215	29.5	
Side	49	13.4	675	16.4	
Unknown	43	11.8	454	11.0	
Soft bedding in sleep environment[e]					.02
Yes	264	72.3	2804	68.2	
Not specified	101	27.7	1309	31.8	
Number of unsafe sleep factors[f]					<.001
1	71	19.5	729	17.7	
2	192	52.6	2067	50.3	
3	94	25.8	1308	31.8	
Could not be determined	8	2.2	9	<1	

Cell counts between 0 and 6 are suppressed to maintain confidentiality.
One percent of total cases have missing or unknown information for plurality and were removed from this table.
Missing was <3% for all variables.
A missing response indicates the question was skipped during data entry. An unknown response indicates the question was considered however the information necessary to answer the question was not available to anyone.[19]
[a] Missing data were excluded from the χ-square analysis.
[b] Adults include infants who were sharing with 1 or more adults; children include infants who were sharing with 1 or more other children.
[c] ≤6 infants were surface sharing with just a pet.
[d] Includes floor, car seat.
[e] Excludes noncrib mattress; excludes cushion when incident sleep place is couch; these variables were only indicated as affirmative in the data as a result, it is not possible to discern between missing, unknown, and no.
[f] Factors include soft bedding; not in a crib, bassinet, or portable crib; and prone or side position. Zero unsafe sleep factors could not be determined because the soft bedding variable does not distinguish between missing, unknown, and no.

supine (41.8%). Finally, as compared with surface-sharing multiples, a larger proportion of surface-sharing singletons had more unsafe sleep factors in addition to surface sharing in their environment; specifically, 25.8% of surface-sharing multiples had all 3 unsafe sleep factors as compared with 31.8% of surface-sharing singletons. Among surface-sharing SUID, the difference between multiples and singletons with respect to having soft bedding in the sleep environment was not clinically meaningful.

DISCUSSION

Overall, 59.5% of SUID were surface sharing when they died; 40.5% were not. These percentages are similar to other studies of SIDS and SUID (49.6% to 64.1%).[6,13,14] Surface sharing among live infants ranges from 10.1% to 61.4% depending on study population.[2,6,26–30]

Compared with nonsharing infants, sharing infants were more often 0 to 3 months old, non-Hispanic Black, publicly insured, found supine, in an adult bed or chair/couch, with a higher number of unsafe sleep factors (in addition to surface sharing) present, were exposed to prenatal maternal cigarette smoking, were supervised by a parent at time of death, or had a supervisor who was impaired by drugs or alcohol at time of death. Compared with sharing, nonsharing infants were more often >3 months old, non-Hispanic white, privately insured, found prone, in a crib, or had soft bedding in the sleep environment.

Many factors associated with surface sharing among living infants are similar to characteristics we described for surface-sharing SUID. Surface sharing among living

infants has been shown to vary by measures of poverty and the following: non-Hispanic Black or racial or ethnic minorities, lower parental education, teenage motherhood, lower income, breastfeeding, maternal smoking, and residential mobility (ie, moved at least once since birth).[26–33]

The prevalence of SUID exposed to prenatal maternal cigarette smoking (36.5% among SUID in the Registry; 41.4% among sharing and 30.5% among nonsharing infants) was higher than the 2020 US rate of 5.5% among all births.[34] Maternal smoking is a known risk factor for SIDS and SUID, and the risk of SIDS associated with surface sharing increases when 1 or both parents smoke or when the infant's mother smoked during pregnancy.[4–6,35–39] Surface sharing-related risk for SIDS increases 10-fold when surface sharing occurs with a current smoker or if the pregnant parent smoked during pregnancy.[1,4,5,40–44]

Breastfeeding is a protective factor against SIDS and mother-infant surface sharing has been encouraged by some to facilitate breastfeeding,[4,45–47] despite American Academy Pediatrics (AAP)'s recommendation of nonshared infant sleep surfaces.[1–5,48] Among SUID in our study, there was <5% difference between sharing and nonsharing in the proportion of infants ever breastfed. Interpretation of this finding is limited because "ever breastfed" is typically abstracted from the birth certificate, which only documents breastfeeding initiation, and not exclusivity and duration.[49]

Multiple births are more likely to be preterm or have low birth weight, increasing the risk of SIDS.[4] AAP recommends multiples sleep on separate surfaces.[50] However, we found among SUID, surface sharing was more common among multiples than singletons, most often in an adult bed followed by the same crib. Other studies have similarly found multiples more commonly surface share than singletons.[51,52] Parents with multiples cite space and financial constraints as reasons for placing their infants to sleep on a shared surface.[53] This finding has important implications because multiples are over-represented among SUID, both in our study and US death data. During 2011 to 2020, 5.9% of US SUID were multiples,[15] whereas 3.4% of US births were multiples.[34]

Although some characteristics were more common among surface sharing or nonsharing infants, and future research may be necessary to identify the etiology of those differences, most SUID had at least 1 unsafe factor in their sleep environment regardless of surface sharing status. Surface sharing in the absence of other unsafe sleep factors was rare. Furthermore, nonsharing infants were commonly in both an unsafe sleep position and with soft bedding in their sleep environment. Thus, surface-sharing in and of itself may not be what caregiver education should focus on. These results support efforts to provide comprehensive safe sleep messaging and not focus solely on not surface sharing, for all families at every encounter.

Clinicians can use evidence from this and previous studies to shape conversations on safe sleep guidance, including understanding motivations for surface sharing[2,54,55] and the impact of modeling behavior and giving advice to encourage safe sleep practices.[26,56,57] Previously reported reasons for surface sharing included breastfeeding, facilitating better sleep for the infant or mother, calming a fussy infant, convenience, keeping a close watch over the infant, and protection from environmental dangers.[2,54,55] African American mothers reported privacy, concern about becoming accustomed to always sleeping in the parents' bed, and fear about suffocation as reasons for not surface sharing.[55]

Most infants in our study were being cared for by a parent when they died. This finding is relevant because parental practices may be influenced by practices observed in the hospital[56] or advice from healthcare providers (eg, safe sleep recommendations or smoking cessation)[26,57] can impact behavior. Thus, it is critical for healthcare providers to appropriately model and discuss planned and actual infant sleep practices during prenatal visits, birth hospitalization, and postnatal and well-child visits. Engaging parents in discussions about their sleep practices and helping them make decisions to address their concerns and also reduce SUID risk is valuable.

As surface sharing infants more commonly did not have a crib in the home and more often relied on public insurance, when appropriate, pediatricians and other healthcare providers can consider connecting caregivers with free crib distribution programs. These programs can improve safe sleep knowledge and practice.[58–60] Additional research is needed to understand how socioeconomic and other social determinants of health influence infant sleep environments and how best to support families in practicing safe infant sleep.[61–63]

Our analysis has several limitations. First, sleep environment data depends on availability and accuracy of information documented during death investigation, which relies on witness reports of an often chaotic scene.[64] Surface sharing and other unsafe sleep practices may be underreported because of caregiver awareness of safe sleep recommendations and social desirability bias.[5] Caregiver reasons for surface sharing were not available. Second, varying data collection methods and bias may influence information documented in the Registry.[65] For example, there was no standard assessment (eg, blood or breathalyzer) or documentation of drug and alcohol impairment of infant supervisors. Therefore, bias is possible in drug screening if, for example, low-income or nonwhite caregivers were differentially screened for substance use.[66,67] Third, our study population was limited to 23 US states and

jurisdictions, which may limit generalizability. However, the Registry represents a third of US SUID and has wide geographic diversity. Fourth, cautious interpretation of crib availability is warranted because of a high number of unknown responses. Finally, we were unable to determine risk because the Registry includes only infant deaths and thus, we lacked an appropriate comparison group (eg, living infants).

CONCLUSIONS

Characteristics of surface sharing and nonsharing infants among SUID varied by age at death, race and ethnicity, infant insurance type, and presence of unsafe sleep factors. However, most SUID had multiple unsafe sleep factors present regardless of sharing status. The safest place for an infant to sleep is supine, on a nonshared sleep surface, in a crib or bassinet, and without soft bedding.[5] Supporting families in following the AAP recommendations for reducing sleep-related infant deaths[5] is complex. Our findings support comprehensive safe sleep counseling for every family at every encounter beyond just asking where an infant is sleeping.

ABBREVIATIONS

AAP: American Academy of Pediatrics
CI: confidence interval
NFR-CRS: National Fatality Review-Case Reporting System
SIDS: sudden infant death syndrome
SUID: sudden unexpected infant deaths

ACKNOWLEDGMENTS

We thank SUID Case Registry awardees (cooperative agreements DP09-904, DP12-1202, DP14-1403, DP15-1506, DP18-1806) in Alaska; Arizona; San Francisco County, California; Colorado; Delaware; Georgia; Cook County, Illinois; Indiana; Kentucky; Louisiana; Maryland; Michigan; Minnesota; New Hampshire; New Jersey; New Mexico; Nevada; Pennsylvania; Tennessee; Utah; Tidewater Region of Virginia; Pierce County, Washington; and Wisconsin. We thank the leadership and data team Abby Collier, Heather Dykstra, and Esther Shaw, at the National Center for Fatality Review and Prevention for their support in preparing data from the NFR-CRS. We thank the Health Resources and Services Administration Maternal and Child Health Bureau for their longstanding support of the child death review programs.

FUNDING: No external funding.

CONFLICT OF INTEREST DISCLOSURES: The authors have no potential conflicts of interest to disclose.

DISCLAIMER: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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