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Understanding parental choices related to infant sleep practices in the United States using a mixed methods approach

Hannah Sahud[1], Rachel P. Berger[1*], Megan Hamm[2], Emily Heineman[1], Flor Cameron[2], Julia Wasilewski[2], Ashley Griffin[3] and Gysella B. Muniz[3]

Abstract

Background This study aimed to gather information about parental practices, knowledge, and attitudes regarding infant sleep habits and environments, among families who practice non-recommended sleep practices.

Methods We conducted one-on-one phone interviews with parents who had practiced non-recommended sleep methods with their infant and had or had not experienced an undesirable sleep event such as a fall. Interviews were recorded and coded with MAXQDA software. Intercoder reliability was assessed for consistency.

Results Thirty-one parents consented, and 21 interviews were conducted. Parents were aware of current American Academy of Pediatrics (AAP) sleep recommendations for infants, knew about the sleep risks of non-recommended practices and had access to a recommended sleep environment. Parents reported developing modifications to the sleep environment which they perceived made their infant's sleep safer. Many parents felt that they could not be honest with their primary care provider about utilizing a non-recommended sleep environment; many had not had a detailed conversation with their primary care provider about safe sleep.

Conclusions Our data are consistent with previous studies which demonstrate that lack of access to a recommended sleep space or lack of knowledge about AAP sleep guidelines are not the primary reasons for practicing non-recommended sleep habits. Our data highlights the disconnect between the current AAP safe sleep recommendations and what parents feel is feasible to do on a daily basis. Evaluating the impact of a risk elimination strategy which is used in the US compared with a risk mitigation strategy which is used in other countries on parental practice and ability to communicate honestly with primary care providers is a future area of research.

Keywords Sudden unexpected infant death, Sleep-related event

*Correspondence:
Rachel P. Berger
rachel.berger@chp.edu
[1] School of Medicine, Division of Child Advocacy, University of Pittsburgh, UPMC Children's Hospital of Pittsburgh, 4401 Penn Avenue, Pittsburgh, PA 15224, USA
[2] University of Pittsburgh Center for Research On Health Care, Pittsburgh, PA, USA
[3] School of Medicine, Division of General Academic Pediatrics, University of Pittsburgh, UPMC Children's Hospital of Pittsburgh, Pittsburgh, PA, USA

Background

Non-recommended sleep practices remain a leading cause of infant mortality in the United States (US) [1, 2]. Public education about the American Academy of Pediatrics (AAP) guidelines for sleep practices has been in place for many years, and data suggest that parents are aware of these current sleep recommendations [3–7]. While other countries have employed a risk mitigation approach to sleep, the approach in the United States is that of risk elimination. The typical adult sleeping arrangement in North America is a raised bed with plush bedding (e.g. sheets, blankets, comforters or quilts, mattress toppers) and may account in part for why infants sleeping in adult beds is particularly dangerous. The prevalence of substance use is another risk to co-sleeping that may have greater prevalence in the US than in other countries. Previous studies have looked at reasons why parents practice non-recommended sleep methods and why this is particularly prevalent in specific populations such as racial minorities, low-income families, and adolescent mothers [3, 8–10]. Numerous reasons for practicing non-recommended sleep methods have been identified. and include breastfeeding, bonding, emotional comfort for mother or infant, increasing the quality and quantity of sleep for mother or infant, parental concerns for safety (e.g., choking), environmental issues (e.g., no crib), cultural traditions, and disagreement with the reported dangers of co-sleeping [11]. Additional barriers to practicing sleep recommendations include inaccurate information about sleep guidelines and lack of trust in the healthcare sources of recommended sleep information [9]. International variations in how safe sleep is conceptualized also play a role on the global impact of safe sleep recommendations and practices [12]. Studies conducted outside the US also demonstrate a gap between parental practices and those safe sleep recommendations [12–15].

While the risk of sudden unexpected infant death (SUID) is the most discussed poor outcome of not following sleep recommendations, sleep injuries (e.g., falling out of bed while co-sleeping) are likely far more common. The risk of infant falls in the newborn nursery is a well-recognized area for hospital-based quality improvement [16–18] and a recent study in New Zealand demonstrated that 84% of neonatal falls were related to mother falling asleep while breastfeeding [18]. In addition, bed and couch falls are an important cause of infant injury [19, 20]; there are no data, to our knowledge, about how often bed falls occur while infants are asleep (vs. awake) but one would hypothesize that the number is substantial given how much infants sleep and the prevalence of utilizing non-recommended sleep practices. A recent study demonstrated that the demographic characteristics and social risk factors among infants with sleep injuries while using non-recommended practices were similar to those with SUID [21]. There are no studies, to our knowledge, which have focused on falls in infants who are not sleeping in accordance with AAP guidelines after discharge from the newborn nursery. We hypothesized that parents of children who sustain non-life-threatening injuries due to non-recommended sleep practice events may be willing to discuss the event—unlike a parent whose infant has died – and provide unique insight into potential approaches to improving compliance with AAP safe sleep recommendations.

Therefore, we recruited parents of infants who were utilizing non-recommended sleep practices, some of whom had had a non-life-threatening sleep event due to this practice and others who had not. We performed a qualitative interview about the event and their knowledge and practices related to non-recommended sleep methods.

Methods

This study was approved by the University of Pittsburgh Institutional Review Board. The COREQ [22] standards for qualitative research were followed. Parents were recruited from the University of Pittsburgh Medical Center (UPMC) Children's Hospital of Pittsburgh Emergency Department (CHPED) and the Children's Primary Care Center (PCC) of Oakland if they either engaged in non-recommended sleep practices or experienced a sleep-related event, which led to a medically attended event in the emergency department or the outpatient setting.Recruitment through the Pitt + Me research network (https://pittplusme.org/) captured parents who self-referred without having had contact with the medical system due to a non-recommended sleep event. Parents who self-referred were eligible if they had an infant under 1 year of age and answered yes to one of the following questions "Do you sometimes or regularly sleep with your infant? or "Does your infant sleep with blankets or toys?".

Enrollment took place from November 17, 2020 to August 17, 2021.. Verbal consent was given by each participant, basic demographic information was collected and families were contacted to set up an interview. Interviews were recorded and the analysis was done based on verbatim transcriptions. This process was conducted by a female qualitative research specialist at the University of Pittsburgh Center for Research on Health Care Data Center (FC), who at the time of interviewing had 5 years of qualitative interviewing experience, and who specializes in the topic of reproductive health but at the time of the interviewing had no specialty in the topic of recommended sleep guidelines. After obtaining consent for enrollment, three attempts were made to contact the family in order

to schedule an interview. These scheduling attempts marked the first interaction between the interviewer and the participants, who were previously unknown to the interviewer.

Interviews were conducted by telephone encounters and participants were compensated $25 for their time. We used the concept of thematic saturation to determine sample size and interviewed participants until the expert interviewer was confident new information was no longer emerging in interviews and that saturation had been reached. The interview guide, which was developed by the study team in conjunction with the qualitative methodologist on the project (MH), and which was not pilot tested due to the difficulty finding participants who met the study criteria, covered the following domains: any sleep-related incident that preceded the interview, the infant's general sleep environment, the parent's understanding of what constitutes a safe sleep environment and safe sleep discussions with their primary care provider (PCP). The interview guide is attached as Appendix A.

In this study, we took a Qualitative Description approach. The use of this approach allows to describe a topic as study participants see it, without abstracting to the level of social theory. This approach is common in qualitative studies conducted within medical fields, and frequently has actionable insight as its goal [23]. The interviewer took notes during the interview to facilitate follow-up probing, but notes were redundant with the transcript and were thus not used in analysis. Interviews were recorded and transcribed, with identifying details redacted. In our analysis, we followed the steps described by Braun & Clarke for conducting a thematic analysis (i.e., becoming familiar with the data, generation of codes, combination of coded data into themes, reviewing themes, determining significance of themes, and reporting of findings) [24]. A codebook was developed based on the content of the interviews and included domains similar to those of the interview guide. The codebook is attached as Appendix B. Two qualitative analysts were trained to use the codebook, and then applied the codebook to 10 transcripts and discussed discrepancies. One analyst coded the remaining 11 transcripts. Coding was completed with MAXQDA software. Completed coding was used by the coders and qualitative methodologist to conduct thematic analyses of the interviews. Themes were discussed with the rest of the study team, who helped to contextualize them within existing literature and knowledge about AAP guidelines for safe infant sleep.

Statistical analysis

Descriptive analyses were performed to describe the study population and compare the likelihood of the parent completing an interview based on whether their infant had had a sleep event while using a non-recommended practice vs. whether they were practicing non-recommended sleep without having an event. SPSS 25.0 (IBM, Armonk NY) was used. A p-value < 0.05 was considered significant.

Definitions

Non-recommended sleep practices definitions were guided by AAP 2022 Recommendations [1], and defined by location, position, and presence of objects in the sleep environment.

Non-recommended sleep location was defined as sleeping at any time (nighttime or daytime naps) on a soft mattress in a non-non-safety approved crib, bassinet or play yard or other surfaces like a bed, couch, armchair, or pillows. Sleeping in recalled products, or any object not intended for sleep (e.g., swing, breastfeeding pillow) were also included in this category. Non-recommended position was defined as placing the infant for both naps and overnight sleep. Presence of soft objects or loose bedding, included the use or presence of any objects in the sleeping area (e.g., stuffed animals and/or loose blankets). Infants should ideally share the same room but sleep in a separate sleep surface as per AAP 2022 guidelines.

A sleep event was defined as a fall or respiratory event which occurred while practicing a non-recommended sleep method as defined above.

Results

Subjects

Thirty-one parents initially consented to be interviewed. Twelve (39%) had infants who had experienced a concerning sleep event; the remainder ($n=19$) practiced an unrecommended sleep method but had not had an event. Ninety-two percent (11/12) of the concerning sleep events were falls off a bed or couch when the infant was sleeping. These falls occurred when the infant was alone on the bed/couch ($n=5$) or with a parent or sibling ($n=6$). In the single event, which was not a fall, the infant was co-sleeping in a bed with his mother and the mother woke up and found the infant unresponsive; the infant was able to be quickly resuscitated at home.

Infant demographics

Subjects were recruited from the UPMC Children's Hospital of Pittsburgh emergency department (35%), the Pitt + Me research network (36%) or a primary care visit (29%). The mean (SD) age of infants was 4.5 (3.5) months and 55% were male. Fifty-two percent were White and 42% were Black; 52% had public insurance. There was no difference in the race of parents who did ($n=21$) or

did not ($n=10$) complete the interview. Parents whose infants were enrolled due to non-recommended sleep practice vs. having a sleep event were more likely to complete an interview but this did not reach statistical significance [84% (16/19) vs 42% (5/12), $p=0.1$].

Availability of a guideline-compliant sleep space

All parents in both groups reported having a sleep space in their home that is in accordance with the AAP safe sleep guidelines and the majority (59%) had two or more of these spaces.

Use of an AAP approved sleep space

Among parents who experienced a sleep even while utilizing a non-recommended sleep method, 27% (3/11) always slept on a bed or couch. The remining 75% (8/11) used an approved space at least some of the time. Sixty-seven percent (8/12) of parents who had a sleep event acknowledged co-sleeping at least some of the time.

Among parents who did not experience a sleep-related event but practiced non-recommended sleep methods, 32% (6/19) always slept on a bed or couch. The remaining 68% (13/19) used a recommended sleep space either routinely or at least some of the time. When infants were in a non-recommended sleep location (e.g. bed or couch), they were always co-sleeping with a parent, parents, or sibling.

Parent interviews

The interview was completed by 68% (21/31) of consented subjects (Table 1). Of the 21 parents who completed an interview, 86% (18/21) were mothers and the remaining 14% (3/21) were fathers. The interview length ranged from 15 to 45 min with an average of 26 min.

The interview focused on four areas of interest that were determined a priori: access to a sleep environment in accordance with AAP recommendations, reasons for non-recommended sleep practices, recognition of the risks of non-recommended sleep and interaction with PCPs as it related to safe sleep. We identified four themes which are each discussed below.

Supporting quotes from the interviews are included in Table 2. Effort was made to quote from an array of different participants. We preferentially included participant quotes which were more descriptive and illustrative of key themes.

Table 1 Participants

	Had an unsafe sleep event	Practiced unsafe sleep without an event	TOTAL
Interviewed	5	16	21
Not interviewed	7	3	10
TOTAL	12	19	

While not all participants were familiar with the explicit term 'safe sleep,' all were able to provide a definition that aligned with the American Academy of Pediatrics 2022 sleep recommendations (Table 2, quotes 1–2).

Four themes emerged from the data analysis, each of which is discussed below:

(1) Theme 1: Despite the availability of a safe sleep environment, concerns about comfort influence infant sleep location and environment.

Although all participants had access to a safe sleep environment in their home, they often did not use these environments because either the infant or the parent was uncomfortable with that sleep environment. Some parents put blankets or stuffed animals in the crib because they felt the infant preferred having them. Some parents put their infants to sleep in environments other than a crib/bassinet and most credited their child's reluctance to stay asleep in the crib/bassinet as the reason for not putting their infant to sleep there (Table 2, quotes 3–4). Another common theme was that parental anxiety played a role in the decisions to co-sleep. Several parents specifically stated that the SUID educational materials caused anxiety, which led them to co-sleep (Table 2, quotes 5–7).

(2) Theme 2: Parents either believe that there is no risk associated with their sleep practice, or that they can mitigate the risk of non-recommended sleep environments.

Parents engaged in what they believed to be preventative measures to reduce potential risks associated with either co-sleeping or other AAP non-recommended sleep practices. Many parents perceive infant falls, rather than suffocation, as the primary risk of non-recommended sleep environments and their risk mitigation measures are focused on reducing the probabilities of this outcome (Table 2, quotes 8–10). In addition to the mitigation strategies focused on the placement of the baby in the center of the bed and not using pillows or blankets when sleeping with the child, many parents referred to themselves as being "light sleepers", feeling confident that they would wake up if the baby became distressed, moved, or made noise (Table 2, quotes 11–12). The lack of negative outcomes from co-sleeping with previous children or with their current infant was also cited as the reason why they felt comfortable co-sleeping (Table 2, quotes 13–14).

(3) Theme 3: Parents feel that recommendations about safe sleep are not realistic or practical.

Table 2 Themes and demonstrative quotes from interviewees

Quotes demonstrating parental understanding of safe sleep	Q1: *"They should be in a crib just by themselves – without anything. On their back, in an empty crib with just them. Um, or bassinet, I guess, but-um, just make sure that it's empty and they sleep on their back." (Participant #15)*
	Q2: *"The safest place for the baby to sleep, either in their bassinet or a crib depending on age obviously. No bumper pads, no big pillows, no big stuffed animals, no big blankets, nothing that they can get wrapped up in or that could fall on their face. Um, no smoking or any, you know, anything that can just inhibit clear breathing. Um, see – placing them on their backs, especially when they're really little because they can't, you know, move around….Not to sleep with them in bed, not to fall asleep holding them 'cause you could drop them or roll over on them." (Participant #29)*
Theme 1: Despite the availability of a safe sleep environment, parents do not always use them due to concerns about 'comfort'—the infant's and their own	Q3: *"I had tried the bassinet. But as soon as she went down, she started crying. So, I had to try to get her back to sleep and instead of trying the bassinet again – I knew that she would, she wouldn't wake up if I put her in the bed." (Participant #15)*
	Q4: *"Every time that I tried to put him in the Pack 'n Play, like shift him over, um, after he was done nursing, he would wake up. And so, I would do this, like 20–30 times a night trying to get him to sleep. And eventually I just kinda gave up, um, and just, like, kept him right next to me. Um, so, um, with the second [baby], we just kinda went right for it [i.e., co-slept]" (Participant #22)*
	Q5: *"When she was so little, I put in the bassinet and I just couldn't see her, couldn't hear her so I barely getting sleep because I wanted to always watch her and to make sure she was still breathing while she asleep. Um so I just put her in a boppy next to me cuz she was closer and I was face to face with her and I felt more comfortable." (Participant #4)*
	Q6: *"For me, it's the comfort of just knowing that she's, like, right there and, again, that we're able to monitor her." (Participant #19)*
	Q7: *"In the hospital they like they make you watch a video about SIDS and everything and that just made me- that made my anxiety go through the roof if…they make you watch a few videos which I feel like is very scary on new mom especially when you're leaving the hospital….I felt like them putting in your head right before you go home with you baby makes it a little traumatizing." (Participant #4)*
Theme 2: Parents either believe that there is no risk associated with their unsafe sleep practice, or that they can mitigate the risk of unsafe sleep environments	Q8: *"I definitely do, um, make sure there's a border, uh, like, off the bed around. So, if he does fall or roll off – because, yeah, he's a roller … I have a border, like off around the bed. So, it's like cushioned-type things. So, if he does fall, you know, he could just hit that and it won't be hard, it won't hurt him. It just be, like, a little fall. But I am very protective. I really make him, like, sleep in the middle of the bed." (Participant #8)*
	Q9: "*We're in the living room, you know, our bed is much higher than the couches, so we have an ottoman. So, if I feel like she might roll off of me or something, I push the ottoman up, um, next to the couch. So she would roll onto the ottoman and not onto the floor… the way I fall asleep with her, my – you know, I am know I'm also sleeping at times but um, I haven't really been overly concerned with her falling or getting hurt…..I would definitely be more worried if she was in my actual bed, um, because our bed is higher up on risers. So, if she did fall, you know, that could be a lot more significant. Um. But in our living room, on the couch, we have a thick carpet in here as well. I'm not as concerned." (Participant #18)*
	Q10: *"Both the wife and I sleep at the extremes of the bed and he's in the middle, so that still leaves about a good 20–24 inches between us… he's in the middle of the bed…since he started rolling over, now he kinda rolls over to us. Uh, but, we don't have any pillows either. So, uh, it's just a flat bed. And so, we don't use, uh, bedsheets over us anymore since he started rolling over. So, we've made that a little more safe for him so he doesn't, like, cover his face or do something when we are, uh, asleep. So, um, we kinda feel like he's pretty, uh, surrounded on all four sides. He doesn't, like, turn. So, uh, he's-he's not gonna fall where we're – uh, by our foot. And we have – the bed is up against the wall on the other side, so we feel like he's surrounded on all four sides and is pretty safe." (Participant #28)*
	Q11: *"Whenever she was in the crib, I felt like he [the baby's father] would sleep so much more soundly than I would sleep. And then, when I moved her to the bed, it was, like, he started sleeping lighter. So, um, it almost, again, helped reinforce, like, okay, this is better for me because, you know, now he's sleeping lighter and now the burden's not just on me. Um, and so, it felt a little bit of, like, relief and stuff." (Participant #19)*
	Q12: *"I am very alert when he's on the bed…– I'm not really a deep sleeper, so if I hear him, like, talk or scream or yell, I'll definitely get up, like, very fast." (Participant #8)*
	Q13: *"I do put him in bed with me sometimes. I know that that's not the recommendation, but, I mean, I honestly don't feel like I'm doing anything, like, risk or harmful to him." (Participant #29)*
	Q14: *"I ain't gonna do nothing to her that I didn't do to my other three kids. All my other three kids are alright. They still here. And ain't nothing wrong with them." (Participant #26)*

Table 2 (continued)

Theme 3: Parents do not feel that recommendations about safe sleep are realistic or practical	Q15: *"When you're an actual parent and you're up all night and, you know, you do what you can to make sure that your baby is fed and happy and if the baby can sleep on you, you know, and-and you can catch an hour or two, then that's great. Um, 'cause I've tried putting her in the pack and play at night and she wakes up right away screaming and then, you know, you're back and up all night… Put the baby in their crib, you know, but in real life, you know, it's aren't—it's not as easy as that." (Participant #18)*
	Q16: "*It all sounds great in theory. I just don't know how to put it into practice from a realistic, practical standpoint." (Participant #19)*
	Q17: *"I don't think' it's real – it's not always realistic….I think they [primary care providers] need to be more realistic about, you know, when, uh, parents are tired or caregivers are tired and, um, you know, they don't always do a hundred percent of what is recommended." (Participant #21)*
	Q18: *"…I can try not to put him in bed with me. That's fine, but I can't guarantee that it's not gonna' happen on nights when we're tired and people need to get sleep." (Participant #29)*
Theme 4: Parents indicate problematic aspects to their interactions with their PCP including lack of detailed safe sleep discussions, feeling judged by their PCPs, and condoning of unsafe sleep practices by the PCP	Q19: *"I think the only thing they ask is, you know, like, 'How are things going?' And you're like, 'Everything is fine.' 'How -how long is the baby sleeping?' I don't think I was ever asked, 'Where is the baby sleeping?' at the pediatrician. So, um, it they prodded more, we would talk more about it." (Participant #18)*
	Q20: *"I would nod my head and I would go, okay, thank you so– much, I appreciate you're—you let me know. And I would probably say, yeah, I'm not gonna do that anymore. And then I would come home, and I would do the exact same thing that I've been doing."* She added that she does not *"like being shamed into, oh, this isn't the right thing to do. 'Cause I know that it's not what's recommended, but, again, from a practical standpoint, it's hard to—like, anytime you talk about co-sleeping, I feel like you're always on the defensive side to justify, um, and defend why you choose to do that."* "*Honestly, I wish that the stigma of – like I said, part of the reason that I think people don't talk about it is 'cause of the shame associated with it and, like, the – it's see, oh, you're-you're endangering your child and you're doing something that's going to potentially hurt them and all this stuff. And there's a lot of shame associated with-with co-sleeping. Um, and I wish that were something that were less – I wish it were, like – that it was, uh, you know, demonized less in the medical field. Because, again, like, these are supposed to be providers that are helping you care for your kid or children (Participant #19)*
	Q21: *"Every time he got an ear infection, he'd just co-sleep at night. Uh, the episodes were usually at nighttime. Um, so, we just started co-sleeping with him after we heard a little bit about it….Even yesterday we had a PCP visit 'cause he- he seems to be on his next cycle of ear infection. So, um, we went for a check-up and we brought it up to his PCP, and he felt the same way. Just let him fully recover, let him get a little bit older before we start trying to get him back to sleeping in his own room. And he felt like it's okay as long as we are careful right now. […] He said it was fine as long as we are safe….the first time we brought it up, he said just be careful and like, he walked us through, like the safe, um habits. Like, what all can happen. Like suffocating on a blanket or a toy. Even, like, pillows and things like that. And we implemented it…we have implemented everything the pediatrician told us to do. […] I think they are pretty understanding…even in our discussion yesterday, um, when we explained the situation to them…he felt like that's a smart choice, a smart decision that we are doing" (Participant #28)*
	Q22: *"I don't think that they would give me any problem about it. I think the only thing that they would say is, you know, they're obligated as a pediatrician to tell you the-the risks – the risks and the concerns of co-sleeping or putting a baby in your bed. I think that us, as a doctor, they're obligated to, you know, relay that information to you. So, I think if anything, I think that they would say, like oh, you know, um, you know, that's not recommended, blah, blah, blah. But, uh, that's about all I think they would say." (Participant #29)*
Quotes describing parents' decision-making to stop co-sleeping	Q23: *"…soon as they are all able – you know, as soon as they're sleeping more throughout the night, we've always put them in their cribs." (Participant #18)*
	Q24: *"I have not put her in the bed to nap since then." (Participant #15)*
	Q25: *"Well not since the ER visit. She's been sleeping in her bed now…the doctor at the ER told me, like, um, consider it a warning, 'cause I could have rolled the other way and crushed her, which is even more terrifying. So, that was what really, you know, woke me up to stop co-sleeping." (Participant #12)*

Many parents described AAP safe sleep recommendations as unrealistic or impractical when faced with the demands of parenting an infant, running their household, and/or holding a job. (Table 2, quotes 15–18).

(4) Theme 4: Parents indicate problematic aspects when interacting with their PCP including lack of detailed safe sleep discussions, feeling judged, and condoning of non-recommended sleep practices by the PCP.

When asked about interactions with their PCPs about safe sleep, participants indicated that either they hadn't had a conversation about safe sleep or their PCP "simply checks in" to see if they have a sleep space in accordance with AAP guidelines, but doesn't delve into details (e.g., they ask about the availability of a safe sleep space, but do not ask about the details of the baby's sleep routine) (Table 2, quote 19). Most parents were not sure how to improve the conversation or how to make it clearer. Some parents suggested providing resources or ideas to help with sleep issues and making it a point to ask more open-ended questions about sleep practices. One participant stressed the importance of this conversation taking place in a way that parents don't feel judged for their choices (Table 2, quote 20). Several participants stated that they want providers to understand that while AAP sleep recommendations make sense, they do not fit into every family dynamic and are not 100% implemented. Multiple parents reported that they felt that their child's healthcare provider had condoned AAP non-recommended sleep practices (Table 2, quotes 21–22). When asked what they would do if a healthcare provider did not condone the non-recommended sleep practice, some parents stated that they would dismiss the provider's advice (Table 2, quotes 20, 22).

Impact of the non-recommended sleep event

Parents who had experienced a sleep event while utilizing non-recommended sleep practices were asked about the circumstances and the impact of the event. Within the group, several parents commented that they routinely practiced AAP compliant sleep and planned to practice AAP compliant sleep, but that the non-recommended sleep condition related to the event happened accidentally (e.g., parent accidentally fell asleep while feeding the infant and the infant fell to the floor from the chair). Four of the five parents, changed their sleep practices as a result of that event (Table 2, quotes 23–25).

Discussion

Non-recommended sleep practices continue to be a topic of public health concern despite decades of education and prevention campaigns. With the goal of developing interventions that might prevent negative infant sleep related outcomes, our study assessed parents who are practicing or have practiced non-recommended sleep methods to determine what influenced them to do so.

The fact that parents were universally able to describe AAP-compliant sleep and/or had a compliant surface for their infant to sleep is encouraging and suggests the years of public health efforts, which have been focused on education about the ABCs of safe sleep and ensuring access to compliant sleep surfaces, have been successful. Our data are also consistent with two recent publications which demonstrated a high level of knowledge about AAP sleep guidelines [25, 26]. Knowledge and the presence of a crib (or equivalent recommended sleep surface) are strategic and critical, but not sufficient on their own to practice safe sleep. Most hospitals and birthing centers in the US systematically screen families, identifying those in need of a recommended sleep surface, many providing these for free.

Studies have shared a gap between knowledge of AAP recommended sleep content and lack of translation into real-life sleep practices. [15] The finding that parents try to mitigate risks of non-recommended sleep is important for several reasons. It demonstrates that parents want to keep their babies safe. Knowing their decisions and behaviors can impact infant sleep (e.g. placing pillows around the baby, placing the baby in the center of the bed). Parents are willing to take extra time to set up an environment which they believe to be safe. It also suggests that while parents may be able to accurately state what recommended sleep practice is, they may not understand the reasons behind these recommendations, leading to unsafe mitigation techniques. For example, the mitigation strategies observed among participants in this study were designed to minimize the risk of a fall, but it isn't clear how much parents took into consideration the risk of suffocation.

Caregiver challenges implementing recommended sleep practices have been addressed by other authors. Cole et al. identified sleep position and bed sharing as the most challenging recommendations to adhere to [15]. There is consensus among guidelines around the world as it relates to the importance of a firm, flat horizontal surface, supine position, breast feeding, and the avoidance of loose blankets and overheating. But there are also differences among countries related to shared sleeping space (risk elimination vs risk mitigation), use of in-bed portable sleep spaces, use of sleep sacks, pacifiers, and swaddling [12].

It is critical to also recognize the impact of social determinants of health on the ability of some parents to practice AAP compliant sleep. Parents may have limited capacity to address the demands expected of them; remembering to put an infant to sleep on a recommended sleep surface, on their back, while complying to additional AAP sleep recommendations. This may be overlooked among caregivers distressed by economic scarcity or a parent who needs to return to work soon after a baby's birth. Addressing social determinants of health is likely to impact negative sleep outcomes as well as child maltreatment [21].

We recognize that risk minimization strategies are recommended in some countries while the US recommends

a risk elimination strategy. The Safer Infant Sleep guidelines from Queensland Australia specifically addresses the risks and benefits of sharing sleep surfaces and describes risk minimization strategies divided by aspect (infant, position, surface, fall/entrapment and environment). Neutral language in conveying safe sleep information is specifically recommended in these guidelines [27]. These guidelines, as well as the AAP guidelines, clearly identify high risk characteristics where shared sleep should never occur, e.g. smoking households, with caretakers under the influence of alcohol or substances, premature infants (gestation age less than 37 weeks) and/or infants with birth weights less than 2.5 kg. The AAP 2022 Safe Sleep guidelines offer a risk elimination approach by not recommending bed sharing under any circumstance. It also specifies the risks of sleeping with non-parental care givers and risks for term, adequate for gestational age infants < 4 months of age. We are unaware of data that clearly demonstrates which of these approaches – risk mitigation vs. risk elimination – is more effective in decreasing SUID and specifically, non-recommended sleep related deaths.

The fact that several parents perceived that their PCP agreed with their risk mitigation strategies is concerning; it is possible that parents misunderstood their PCP or only heard what they wanted from their discussion. The volume of patients and time constrains during outpatient visits consistently limit the amount of time primary care providers have for in-depth discussions about sleep habits. The limited and often narrowly focused sleep screening questions that auto-populate in some electronic health records make it challenging to accurately capture what takes place during the PCP visit. The provider is one of many sources of information for new parents. The quality and accuracy of safe sleep information from sources other than PCPs is likely to be even more inconsistent [28–30].

The impact of social networks which seem to heavily influence parental sleep practices [28] in combination with mistrust of medical providers [31] are important areas of research to bridge the gap between knowledge and practice. A study examining adolescent mothers and infant sleep practices found that these mothers often believed their instincts took precedence over medical advice [32]. This is consistent with data from Colson and colleagues who identified lack of trust in the PCP as a potential barrier to sleep guideline compliance in a high-risk cohort of mothers [9]. Several participants in our study reported that messaging from their PCP was perceived as judgement-laden and/or that they would disregard what their PCP said about safe sleep. While it is possible that PCPs could improve their discussions with families to be less judgmental, it is also possible that their advice was consistent with AAP recommendations but interpreted as negative by parents. As alternatives like co-sleeping or co-bedding were labeled unsafe, this conflicted with information parents had encountered in the media or though their social networks. Unidirectional education is received with less acceptance by families who might not voice their opinion at the time of visit to avoid labeling or stigmatization. We believe that there is a recognized need for transparent and nonjudgemental conversations to create a safe space and bidirectional dialogs among caregivers and healthcare providers.

Our finding that education about SUID can increase anxiety in some parents, potentially leading to co-sleeping was reported by Cooper and colleagues more than 10 years ago [33]. It is unclear how common this anxiety may be, but it highlights a potential area of research given the overall increasing rates of anxiety in the US over the past 10 years [34]. A recent study looking at Facebook conversations as a way to evaluate maternal understanding of SUID demonstrated that while anxiety about SUID itself was fairly common [29], the possibility of SUID education itself causing anxiety and subsequent co-sleeping was not addressed. Providers who educate new mothers about sleep practices should be aware that education about SUID may inadvertently cause or increase anxiety, and paradoxically, lead to the use of non-recommended sleep practices. Awareness of advice does not necessarily translate into safe sleep practices overall. Cole et al. concludes that despite identifying safe sleep recommendations, caregivers did not always align with those recommendations, highlighting that better understanding of caregivers' experiences and difficulties is an area of further education and intervention [13].

Within the group of parents whose infant experienced a sleep event while practicing a non-recommended method, there appeared to be a subgroup who had not chosen to co-sleep, but rather accidentally co-slept at the time of the event. It may be important for PCPs to recognize that this category exists, especially if they do not provide additional infant sleep education when parents indicate they are using a recommended space and intend to follow safe sleep practices. Counseling about the risk of these kinds of accidental situations where a non-recommended sleep practice unwittingly occurs is an important aspect of realistic sleep education and should be done for every parent regardless of their intent to follow guideline-compliant recommendations.

Although our initial intention was to only interview parents whose children experienced unsafe sleep events during non-recommended sleep practices, this group had a significantly lower rate of completing the interview. We hypothesized that this could be linked to the guilt parents felt about the event and/or the stigma associated

with admitting that their actions directly contributed to their infant experiencing an unsafe sleep event. This was particularly true since many parents acknowledged that they knew the sleep practice they used was not recommended. Unlike the parents who self-referred through the Pitt + Me research network, parents who experienced a medically attended sleep event were approached for participation after an ED visit associated with this event. These differences are important and demonstrate that it may be difficult to get data from parents who accidentally co-sleep and have a sleep event.

This study has several limitations. Our data are dependent on parental reporting which is limited by recall bias and social-desirability bias. Our hope was that conducting interviews by phone would decrease parental concern for social desirability [35]. Recall bias is less of a concern in parents who regularly co-sleep but could be a limitation for parents who co-sleep only intermittently. Finally, as mentioned previously, parental reports about conversations with PCPs may not reflect the actual interaction and may instead reflect parental perception about their discussions. This has important implications for redesigning or changing the way in which PCPs provide safe sleep education and speak with families about sleep.

SUID remains the leading cause of death in infants with non-recommended sleep practices being an important contributor to these deaths. Our study adds to the growing data which can help us understand why parents don't practice AAP guideline compliant sleep despite having a high level of knowledge about how to do so. Additional research is needed to study how to use these data to best develop interventions which address social determinants of health, acknowledge the realities of parenting and work to improve the ability of parents to communicate with their primary care providers. This research needs to be done in a culturally sensitive way, recognizing the differences in approaches between the US where a risk elimination strategy is advocated and other countries which have favored a risk mitigation strategy.

Abbreviations

AAP	American Academy of Pediatrics
PCP	Primary care provider
SUID	Sudden unexpected infant death

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
The manuscript has been read and approved by all the authors, the requirements for authorship has been met and agreed upon by all authors. GM: Project development, manuscript editing, RB: Project development, data analysis, manuscript writing, HS, MH: Data collection, data analysis, manuscript writing, EH: Project development, data analysis, manuscript editing, FC, JW, AG: Data collection, data analysis, manuscript editing.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the University of Pittsburgh Institutional Review Board. Informed consent was obtained from all participants.

Consent for publication
Not applicable.

Competing interests
All the authors report no conflict of interest.

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