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## Research paper

# Optimizing the sleep position of infants and embroidered “I sleep on my back” sleeping bags in maternity hospitals

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## ABSTRACT

**Objective:** To evaluate the impact in maternity hospitals of using an embroidered “I sleep on my back” sleeping bag on observing the sleeping recommendations at 1 month after birth.

**Method:** This was a multicentere prospective study, exposed/unexposed type, in which mothers answered questionnaires (by telephone and online) 1 month after giving birth. The exposed group consisted of mothers who had given birth in a maternity hospital of the ELENA network in which the embroidered sleeping bag was used as a preventive action; the unexposed group of mothers gave birth in a maternity hospital of the RP2S network, without this specific preventive action.

**Results:** A total of 540 mothers participated in the study: 245 in the exposed group and 295 in the unexposed group. In the exposed group, 87.3% of infants slept exclusively on their back versus 75.9% in the unexposed group ( $P < 0.001$ ); 91% of the mothers reported having actually used the sleeping bag. Except for room-sharing, compliance with the other sleeping recommendations was higher in the exposed group.

**Conclusion:** Sleeping practices when infants were 1 month old were not optimal in our study population. A simple preventive initiative in maternity hospitals, using the embroidered “I sleep on my back” sleeping bags, is relevant and effective in improving compliance with the sleeping recommendations for infants at home.

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## 1. Introduction

Sudden infant death syndrome (SIDS), defined as the sudden death of a healthy child under 1 year of age, represents the leading cause of infant mortality in developed countries, and particularly in France where it affects 300–400 infants annually (0.4/1000 births) [1]. After an exhaustive etiological assessment, including case history, examining the place of death, clinical examination, biological samples, medical imaging, and an autopsy, it may be possible to attribute SIDS to an infectious, genetic, cardiac, metabolic, or even traumatic cause. But recent data from the French National Observatory on SIDS confirm that, independently of these medical–scientific explanations, half of the cases of SIDS are accidental and probably avoidable if the simple prevention measures recommended for sleeping environments are respected [2].

Recommendations for safe sleeping, proposed by the American Academy of Pediatrics (AAP) and updated in 2016, are the current best practice [3].

In France, in the absence of a national campaign aimed at users (the last government campaign aimed at preventing SIDS was in 1998), prevention messages from healthcare professionals are of major importance for raising awareness among parents. In two recent French academic studies on sleeping practices for infants, it was found that only 66–76% were put to sleep on their back at 1 month of age [4,5].

Professionals from the Loire Nord Ardèche (ELENA) perinatal network devised an original tool to spread the prevention message from the maternity hospital to encourage sleeping on the back: embroidered “I sleep on my back” (baby) sleeping bags, which are systematically used in postpartum recovery rooms. As such, in the three main maternity hospitals of the ELENA network, these sleeping bags were recommended in the delivery room and used for the newborn for 72–96 h after birth, as a routine practice (without recorded parental consent). The maternity wards of the

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Perinatal Network of two Savoie (RP2S) did not use this material, and had not implemented a concerted prevention action.

The main objective of the study was to assess the impact of these embroidered “I sleep on my back” sleeping bags in maternity hospitals on the sleep position of infants at 1 month of age, by comparing two infant populations from these two perinatal networks of the Auvergne Rhône-Alpes region.

The secondary objectives were:

- to assess the impact of using this preventive tool on the other recommendations for safe sleeping;
- to evaluate the exposure to other protective or risk factors for SIDS for this 1-month-old population;
- to describe the sleeping and prevention practices reported by the maternity hospitals and the prevention messages heard by the mothers.

## 2. Materials and methods

An observational multicenter prospective study with exposed/unexposed types was carried out on the basis of questionnaires that were self-administered or administered by another person.

All the mothers who gave birth in the participating maternity hospitals over a predetermined period during the first quarter of 2019 were candidates for inclusion in the study.

Exclusion criteria were hospitalization of the newborn (neonatology, neonatal intensive care, or “kangaroo” units), not being fluent in French, minor mothers or mothers under protective measures (guardianship), multiple births, mothers having given birth in secret, and refusal to participate in the study.

The inclusion period of 3 weeks could be extended if necessary, to reach the required number of target subjects.

Mothers having given birth in one of the three maternity hospitals in the ELENA network made up the exposed group, and those from the eight maternity hospitals in the RP2S network made up the unexposed group. The mothers from the exposed group were interviewed about their actual exposure to the embroidered “I sleep on my back” sleeping bag. The mothers who reported having actually benefited from the sleeping bag were defined as the “sleeping bag exposed +” subgroup. The mothers who reported not having benefited from the sleeping bag made up the “sleeping bag exposed-” subgroup.

The questionnaire was self-administered online or administered by another person by telephone, depending on the mother’s choice. The data were collected between 4 and 6 weeks after birth.

The questions related to sleeping practices, including room-sharing (co-rooming), sharing the same sleeping surface (bed-sharing), and the infant’s environment; the existence of ante-, peri-, and postnatal prevention messages received by the mothers; and simple and descriptive data (age, parity, level of education and that of the spouse).

Information on prevention and sleeping practices in the maternity hospitals was gathered based on a questionnaire administered to the coordinating midwives at each center. The data collected dealt with the information received in the maternity hospital about sleeping, on effective sleeping conditions while staying in postpartum recovery rooms, on the materials provided or allowed, and on the practices allowed or not.

The main judgment criterion was the frequency of infants sleeping exclusively on their back at 1 month of age. The secondary criteria concerned adapted sleeping elements other than dorsal recumbency and considered by the AAP (firm mattress, absence of objects in the bed, type of bed, room-sharing, and absence of bed-sharing). The other protective factors considered were

breastfeeding and a pacifier being available. The other risk factors considered were in utero smoking and passive smoking for the infant, and in utero exposure to alcohol.

The temperature in the bedroom was not considered in the sleep compliance criteria, given the climatic variations between the two networks and the unreliability of the temperatures reported by the parents [4].

The data were collected anonymously in the LimeSurvey software and then entered into and processed in Excel. The consistency of the distributions observed for the qualitative characteristics was tested with Pearson’s chi-squared test and Fisher’s exact test. Student’s t test was used to compare the averages of quantitative parameters of two independent samples. A polychotomous regression was used for the multivariate analysis, carried out on the Stata 9 software (College Station, Tex., USA). The significance threshold was set at 0.05.

The research project was approved by the independent ethics committee at Nancy (Comité de Protection des Personnes: CPP Est III). The consent of all the mothers was collected in writing. The management and processing of the data was subject to the authorization of the French data protection authority (Commission Nationale de l’Informatique et des Libertés).

## 3. Results

### 3.1. Population

Eleven maternity hospitals participated in the study; three using the sleeping bag out of the seven in the ELENA network and eight out of the 12 in the RP2S network. The 11 maternity hospitals were public.

During the inclusion period, 1,780 mothers gave birth in the targeted maternity hospitals. A total of 609 consent forms were obtained, or from 21.5% to 94.7% of births depending on the centers. Overall, 540 patients could be included in the study, or 88.7% of the women who consented to being contacted: 245 in the exposed group and 295 in the unexposed group.

The characteristics of the mothers included in the study are detailed in Table 1. There were some differences between the two groups: more mothers from the exposed group were multiparous. The mothers from the sleeping bag exposed+ subgroup has a higher level of education than the unexposed group.

In total, 190 mothers from the exposed group reported having actually benefited from the embroidered sleeping bag, or 77.6% of the group (34.6%, 82.6%, and 92.0% respectively, in the three maternity hospitals involved).

### 3.2. Reported sleeping practices at 1 month

#### 3.2.1. Exclusive sleeping on the back (exclusive supine sleeping)

Exclusive sleeping on the back was reported by 81.1% of the mothers from the entire study population: 87.3% of the mothers from the exposed group versus 75.9% in the unexposed group ( $P < 0.001$ ). This rate was 91.0% in the sleeping bag exposed+ subgroup; and 74.5% in the in the sleeping bag exposed- subgroup, without a significant difference with the unexposed group. The rate of sleeping on the back as a function of exposure and of the exposure subgroup is shown in Fig. 1.

Side sleeping was more frequent in the unexposed group:  $n = 14$  (4.7%) vs.  $n = 3$  (1.2%),  $P < 0.05$ . A variable sleep position was more frequently reported in the unexposed group:  $n = 54$  (18.3%) vs.  $n = 26$  (10.6%),  $P < 0.01$ . We did not observe a significant difference in prone sleeping between the two groups: unexposed  $n = 3$  (1%) vs. exposed  $n = 2$  (0.8%), ns.

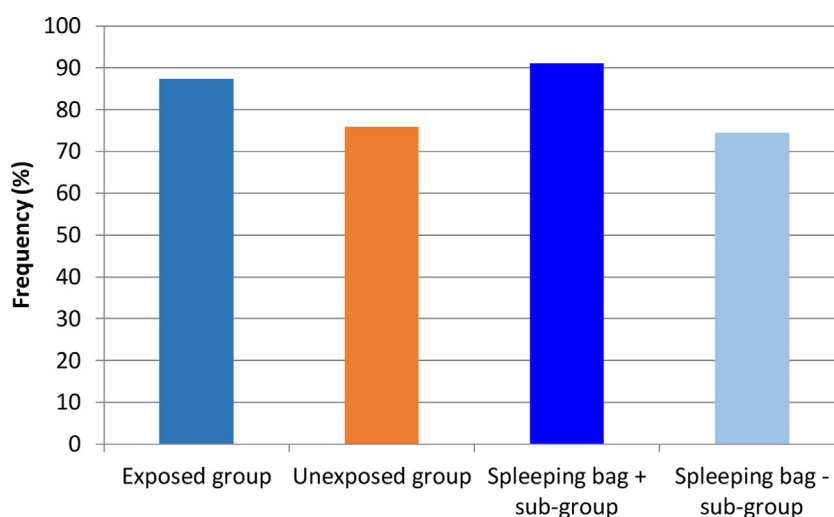
**Table 1**  
Characteristics of the mothers.

	Total population, (n = 540)	Exposed, (n = 245)	Unexposed, (n = 295)	Sleeping bag exposed + subgroup (n = 190)
Age of the mothers				
Average [interquartile]	30.4 [28–33]	30.2 [27–33]	30.4 [28–33]	30.5 [28–34]
< 25 years old	63 (11.7)	28 (11.4)	35 (11.9)	18 (9.5)
25–29 years old	173 (32.0)	80 (32.7)	93 (31.5)	62 (32.6)
30–34 years old	203 (37.6)	95 (38.8)	108 (36.6)	73 (38.4)
≥ 35 years old	101 (18.7)	42 (17.1)	59 (20.0)	37 (19.5)
Parity <sup>a,b</sup>				
Primiparous	240 (44.4)	96 (39.2)	144 (48.8)	71 (37.4)
Multiparous	300 (55.6)	149 (60.8)	151 (51.2)	119 (62.6)
Level of education of the mothers **				
Without diploma and secondary school certificate, n (%)	23 (4.3)	6 (2.4)	17 (5.8)	3 (1.6)
Vocational baccalaureate (school-leavers' diploma) CAP-BEP-BAC, n (%)	173 (32)	85 (34.7)	88 (29.8)	60 (31.6)
Non-specialized studies degree (Bac +2–Bac +4), n (%)	227 (42.0)	96 (39.2)	131 (44.4)	74 (38.9)
Master's–doctorate (Bac +5–Bac +8), n (%)	117 (21.7)	58 (23.7)	59 (20.0)	53 (27.9)
Level of education of the fathers				
Without diploma, secondary school certificate, unknown	46 (8.5)	18 (7.3)	28 (9.5)	11 (5.8)
Vocational baccalaureate (school-leavers' diploma) CAP-BEP-BAC	223 (41.3)	100 (40.8)	123 (41.7)	77 (40.5)
Non-specialized studies degree (Bac +2–Bac +4)	188 (34.8)	90 (36.7)	98 (33.2)	73 (38.4)
Master's–doctorate (Bac +5–Bac +8)	83 (15.4)	37 (15.1)	46 (15.6)	29 (15.3)
Male infant (denominator: data provided)	259 (50.1)	125 (52.5)	134 (48.0)	101 (53.2)

Values are given as number (percentage). CAP: certificat d'aptitude professionnelle; BAC: baccalauréat; BEP: brevet d'études professionnelles.

<sup>a</sup> Significant difference between exposed and unexposed,  $P < 0.05$ .

<sup>b</sup> Significant difference between sleeping bag exposed+ subgroup and unexposed,  $P < 0.05$ .



**Fig. 1.** Frequency (%) of supine sleeping as a function of the exposed group and subgroup (embroidered “I sleep on my back” sleeping bag). Exposed vs. unexposed:  $P < 0.001$ . Sleeping bag + (exposed) vs. unexposed:  $P < 0.001$ .

Table 2 shows the rate of exclusive sleeping on the back as a function of the sociodemographic characteristics of the mothers. Exclusive sleeping on the back was reported to be more frequent among mothers over 25 years of age and with a higher level of education. There was no significant relationship between parity and sleep position. Table 3 shows the odds ratio (OR) for exclusive sleeping on the back as a function of exposure, raw and adjusted to the sociodemographic characteristics of the mothers. The statistical link between exclusive sleeping on the back and the use of the embroidered sleeping bag was only slightly modified by adjusting for maternal age, parity, and level of education, and remained highly significant after adjustment.

### 3.2.2. Compliance with other sleeping recommendations

Table 4 shows the compliance with other sleeping recommendations according to exposure. Except for room-sharing, compliance with the other sleeping recommendations was higher in the exposed group. Sleeping conditions were reported

to be fully compliant with the recommendations by 15.1% of mothers in the exposed group vs. 8.8% in the unexposed group ( $P < 0.05$ ).

### 3.3. Other risk and protective factors

Table 5 shows the exposure of the study population to other protective or risk factors for SIDS at 1 month. Breastfeeding was significantly more frequent in the unexposed group. There was no significant difference between the groups concerning the regular offering of a pacifier when sleepy and passive smoking in the infant. In utero exposure to tobacco and alcohol was more frequent in the unexposed group.

In the entire study population, 12 mothers complied with all the recommendations for safe sleeping by combining all of the SIDS protective factors without any of the risk factors: There were nine in the exposed group (2.2% of the group) and three in the unexposed group (1.0% of the group) ( $P < 0.05$ ).

**Table 2**  
Sleep position and sociodemographic characteristics.

Criterion/sleeping position	Exclusive supine sleep position (n = 438)	Other sleeping position (n = 102)
Age of the mothers		
Average age of the mothers (years)	30.5	29.7
Min–max age	19–46	19–45
Age < 25 years <sup>a</sup>	42 (9.6)	21 (20.6)
Age ≥ 25 years <sup>a</sup>	396 (90.4)	81 (79.4)
Parity		
Average parity	1.76	1.77
Primiparous	191 (43.6)	49 (48)
Multiparous	247 (56.4)	53 (52)
Level of education of the mother <sup>b</sup>		
Without diploma or secondary school certificate	13 (3)	10 (9.8)
Vocational baccalaureate (school-leavers' diploma) CAP-BEP-BAC	135 (30.8)	38 (37.3)
Further education	290 (66.2)	54 (52.9)
Level of education of the father		
Without diploma, secondary school certificate, or unknown	32 (7.3)	14 (13.7)
Vocational baccalaureate (school-leavers' diploma) CAP-BEP-BAC	180 (41.1)	43 (42.2)
Higher education	226 (51.6)	45 (44.1)
Sex of the baby		
Male	210 (48)	49 (48)
Female	210 (48)	48 (47.1)
Not informed	18 (4)	5 (4.9)

Values are given as number (percentage). CAP: certificat d'aptitude professionnelle; BAC: baccalauréat; BEP: brevet d'études professionnelles.

<sup>a</sup> The youngest mothers put their infants to sleep on their backs less often,  $P < 0.01$ .

<sup>b</sup> Mothers with a low level of education put their infants to sleep on their backs less often,  $P < 0.01$ .

**Table 3**  
Supine sleeping and exposure, multivariate analysis.

Targeted group vs. sleeping bag exposed+	Exclusive supine sleeping (%)	OR (95% CI)	OR* (95% CI) <sup>a</sup>
Sleeping bag exposed+ subgroup (n = 190)	91	1	1
Sleeping bag exposed–subgroup (n = 55)	74.6	3.5 (1.6–7.6)	3.1 (1.4–6.9)
Unexposed (n = 295)	75.9	3.2 (1.8–5.7)	3.2 (1.8–5.8)

<sup>a</sup> OR: odds ratio adjusted for maternal age, parity, mother's level of education. CI: confidence interval.

**Table 4**  
Others sleeping recommendations and exposure.

	Exposed (n = 245)	Unexposed (n = 295)	Sleeping bag exposed+ (n = 190)	Sleeping bag exposed– (n = 55)	Total (n = 540)	P, exposed vs unexposed	P, unexposed group vs sleeping bag exposed+ sub-group	P, unexposed group vs sleeping bag exposed – sub-group
Adapted bedding <sup>a</sup>	178 (78.4)	179 (66.5)	143 (75.3)	35 (63.6)	357 (66.1)	< 0.01	< 0.001	0.68
Co-rooming	180 (73.5)	249 (84.4)	134 (70.5)	46 (83.6)	429 (79.4)	< 0.01	< 0.001	0.89
No bed sharing	144 (58.8)	107 (36.3)	117 (61.6)	27 (49.1)	251 (46.5)	< 0.001	< 0.001	0.07
No other material in the bed	116 (47.3)	114 (38.6)	86 (45.3)	30 (54.5)	230 (42.6)	< 0.05	0.15	< 0.05
Totally compliant sleeping <sup>b</sup>	37 (15.1)	26 (8.8)	29 (15.3)	8 (14.5)	63 (11.7)	< 0.05	< 0.05	0.19

Presentation of the table: actual (percentage, denominator: data entered), vs: versus.

<sup>a</sup> single bed and firm mattress.

<sup>b</sup> Adapted bedding, no other material in the bed, co-rooming, no bed sharing, and exclusive supine sleep position.

**Table 5**  
Exposure to protective or risk factors.

	Exposed (n = 245)	Unexposed (n = 295)	Total (n = 540)	P
Breastfeeding	140 (57.1)	207 (70.2)	347 (64.3)	< 0.05
Regular offering of pacifier	106 (43.3)	125 (42.4)	231 (42.8)	0.84
In utero exposure to tobacco	18 (7.3)	47 (15.9)	65 (12.0)	< 0.05
Passive smoking	8 (3.3)	12 (4.1)	20 (3.7)	0.62
In utero exposure to alcohol	10 (4.1)	26 (8.8)	36 (6.7)	< 0.05

Values given in numbers (percentage).

### 3.4. Information on the sleeping recommendations received by the mothers

The rate of mothers who reported having received information from a healthcare professional during pregnancy was similar in the two groups (51.5% vs. 50.2%, or 122 mothers in the exposed group vs. 142 in the unexposed group). The mothers in the exposed group more often reported having received information during their stay at the maternity hospital (96.3% vs. 85.1%, or 233 mothers in the exposed group vs. 246 in the unexposed group,  $P < 0.001$ ). The mothers in the unexposed group more often reported having received information from a healthcare professional after leaving the maternity hospital (37.6% vs. 48.5%, or 91 mothers in the exposed group vs. 141 in the unexposed group,  $P < 0.05$ ).

There was no significant difference in exclusive sleeping on the back as a function of the number of periods (ante-, peri-, or postnatal) during which the information was received. Among the women who received the information in the maternity hospital, the rate of infants sleeping on the back at 1 month remained statistically different according to exposure: 87.1% ( $n = 203$ ) in the exposed group vs. 76.4% ( $n = 188$ ) in the unexposed group ( $P < 0.01$ ).

### 3.5. Information policy and sleeping practices in postpartum recovery rooms

#### 3.5.1. Information campaigns for safe sleeping reported by the maternity hospitals

The coordinating midwives of the “postpartum recovery rooms” were surveyed on the procedures for dispensing information on sleeping for infants. None of the maternity hospitals had a protocol or charter describing the best practices for safe sleeping in the hospital. All of the maternity hospitals reported giving information for safe sleeping. Written supporting information (flyers or pictures) was used in all of the maternity hospitals in the exposed group and in five of the eight maternity hospitals in the unexposed group. Delivery of the information relied on health booklets in nine maternity hospitals. The pediatrician systematically referred to the issue of sleeping in three maternity hospitals in the exposed group and in two of the eight maternity hospitals in the unexposed group. This issue was never broached with the parents in two of the maternity hospitals in the unexposed group. The maternity hospitals in the exposed group participated in the national SIDS prevention week each year and organized information workshops for parents. In these maternity hospitals, no training for healthcare professionals on preventing SIDS had taken place as of the implementation of the embroidered sleeping bags. Some caregivers from the maternity hospitals in the unexposed group had participated in a conference on SIDS organized by the RP2S network the year before the study.

#### 3.5.2. Accepted sleeping practices in postpartum recovery rooms

Two maternity hospitals in the unexposed group reported allowing sleeping on the side in certain circumstances. Five maternity hospitals (two from the exposed group and three from the unexposed group) allowed or offered unsuitable sleeping accessories (cocoons, “angel’s nest” baby sleeping bags, baby pouches). Two maternity hospitals in the unexposed group allowed bed-sharing.

## 4. Discussion

### 4.1. Key results

The objective of the study was to evaluate the effectiveness of a tool for SIDS prevention, in this case an embroidered “I sleep on my

back” (baby) sleeping bag, by comparing two types of maternity hospitals, those already using it versus those who had not yet advocated for it. For all of our study population, we noted a still significant share of unsuitable sleeping habits. Indeed, out of 540 mother–infant dyads from two perinatal networks in the Auvergne Rhône-Alpes region, the rate of infants sleeping exclusively on their backs at 1 month of age was only 81.1%. Although prone sleeping was rare, side sleeping or a “variable” position was frequent. Among the other risk factors, more than one infant in two remained exposed to the presence of material in their bed that is not recommended (cover, bed bumper, etc.), more than one infant in two was also exposed to bed-sharing practices. If we consider all of the AAP criteria, fewer than one infant in eight slept safely. According to the criteria for maximum safety (including protective factors such as breastfeeding and the absence of exposure to tobacco and alcohol), only 2.2% of the 540 infants in this study were fully protected as per the recommendations.

This rate of supine sleeping, 81.1% in our population at 1 month of age, however, was slightly higher than rates reported in two recent French university studies: 66.4% of 107 mothers having given birth at the Sud Francilien Hospital Center during 2012–2013, according to Pupin [5], and 76.2% of 315 mothers having given birth in Bordeaux University Hospital in 2017, according to Leveau [4].

The main finding of our study is the significant positive effect of exposure to the embroidered “I sleep on my back” sleeping bag from the maternity hospital on the way in which 1-month-old infants sleep. As such, the rate of exclusive sleeping on the back increased from 75.9% in the unexposed group to 87.3% in the exposed group and to 91% when the mothers themselves reported having benefited from the embroidered “I sleep on my back” sleeping bag in the maternity hospital. Furthermore, with the exception of room-sharing, the other sleeping recommendations were more frequently followed in the exposed group.

### 4.2. Prevention in public health

The objective for the implementation of this embroidered sleeping bag is to improve parents’ behavior with regard to their infant’s way of sleeping. To lead to a change in practices, in 2004 Grol advocated for action to be taken in different areas [6]: the health message should be innovative and attractive. It should be of interest to targeted users, healthcare professionals, to the social and organizational context, and to the economic, political, and cultural context.

Health messages are often formulated as slogans that, in order to be effective, must appear accessible, achievable, and supported with explanations or answers to users’ questions. In the initiative described here, the message “I sleep on my back” is intended to attract the attention of parents at a particular postnatal moment when healthcare professionals are available to lead the dialogue. This short sentence thus represents a simple message that is easy to put into practice.

The media chosen to disseminate a health message is also important. Most health interventions rely on oral, individual, or collective information sessions. The effectiveness of targeted information sessions has been proven several times. In a study carried out by Moon et al. in Washington, with 310 parents who attended a collective information meeting in a maternity hospital, the authors reported an increase from 45% to 75% in sleeping on the back at 6 months of age [7]. In Béziers, France, a one-on-one intervention in the maternity hospital systematically emphasizing safe sleeping practices and preventive elements for plagiocephaly led to a change in the rate of sleeping on the back from 50% to more than 90% for infants at 1 month of age [8].

All of the maternity hospitals in our study, no matter the network, stated that they provided information about sleeping for

infants to all of the patients, and 90.2% of the women stated having actually received information about sleeping for infants while in the maternity hospital. This rate is far higher than the data from the national perinatal enquiry (NPE) in 2016, which mentions the idea of information in only 51.4% of cases (without descriptions of the type or quality of information received) [9].

Several teams used original prevention materials such as infant clothing. In the United States in 2007, a T-shirt printed with “This side up” was distributed on a large scale in maternity hospitals, but without benefit to the sleep position of infants between 3 and 14 months of age. The initiative was not systematically supported with additional oral information [10].

In order to change a user's behavior, we must pay attention to their knowledge, skills, and misgivings. The slogan “I sleep on my back” does not play on fear but on parenting skills. It aims to reinforce protective behavior rather than point out risky behavior.

The feeling of being immune to the risk of SIDS – “it only happens to other people” – is an obstacle to health messages [11]. The sleeping bag is a preventive item individualized for each newborn and it can encourage parents to think about how their own child sleeps. With a slogan in the first person singular, it is the baby itself talking to the parents.

Parents' fears with regard to strictly sleeping on the back (fear that the baby will choke in case of regurgitation, uncomfortable sleeping conditions, risk of plagiocephaly) constitute other obstacles to the prevention of SIDS. To allay these fears, healthcare professionals should rely on a uniform narrative and be a source of reassurance for parents. The Moon et al. study demonstrated that parents who benefited from a preventive intervention showed fewer fears with regard to sleeping on the back in terms of comfort and inhalation risks [7]. Use of the embroidered sleeping bag in the maternity hospital is a relevant tool, enabling a dialogue with healthcare professionals and encouraging access to information.

Preventive health initiatives are encompassed within an economic and political context. In spite of a stagnation in the number of deaths due to SIDS, no significant national initiative has been planned in France, aside from the data listed in health booklets and the 2005 campaign delivered by the Birth and Life association (Naître et Vivre). This lack of consideration for a public health issue contributed to the field being left open to certain childcare manufacturers and some practitioners promoting unsuitable practices, and to the utilization of useless or even hazardous material (bed bumpers, baby pouches, “anti-sudden death” breathable mattresses, cocoons, monitoring equipment, etc.). In this context, the National Association of French Reference Centers for SIDS published a clarification stressing the importance of sleeping exclusively on the back to prevent SIDS [12]. Recent recommendations from the French Health Authority regarding the prevention of SIDS, but also of positional skull deformities (PSD), highlight the importance of the sleeping environment and of the absence of limitations to the free and spontaneous movement of the infant [13].

#### 4.3. Study limitations

In 2016, the last National Perinatal Enquiry (NPE) analyzed more than 12,000 files of women from more than 500 French maternity hospitals [9]. Compared with the NPE, our study population had: the same average age but a greater proportion of women between the ages of 25 and 34 years; a comparable level of parity; a lower level of maternal education; a lower level of smoking during pregnancy; and a higher level of breastfeeding. Our population would be considered rather low risk, which would reduce its representativeness.

As a result of collecting consent forms in maternity hospitals, the care teams and the mothers were aware of the study in

progress and its purpose. The teams were able to pay greater attention to the information given to the mothers on preventing SIDS and the mothers, knowing that they were participating in the study, had more motivation to follow the sleeping recommendations [14]. This type of methodology could overestimate the rate of adherence to the sleeping recommendations, although this was observed for both groups.

Our study also shows the limits inherent to the declarative collection of data, representative not of actual practices but rather of the mothers' intrinsic knowledge. There may also have been a “social desirability” bias in the group of mothers surveyed by telephone: The presence of another person could have prompted the mothers to show themselves in a more favorable light, but since the method of data collection—whether through another person or an self-administered questionnaire—was not tracked, this factor cannot accurately be studied [15].

We also raised questions on possible confounding biases: Are the best sleeping practices found at 1 month of age in the exposed group linked to the use of an embroidered sleeping bag or to the different practices related to the “cultures” of the maternity hospitals, or the perinatal networks? It is possible that the healthcare professionals at the maternity hospitals using the embroidered sleeping bag are more aware of this issue since they come from a network that already has a prevention policy with regard to SIDS. The information delivered could be even more thorough and the involvement of the caregivers in this mission could be more significant. In our study, information on sleeping received in maternity hospitals was more frequent in the exposed group (96.3% vs. 85.1%,  $P < 0.001$ ). Nevertheless, among the mothers who received the information in the maternity hospital, sleeping on the back at 1 month of age remained statistically linked to exposure. Mothers in the exposed group, but reporting at 1 month of age not having benefited from the embroidered sleeping bag in postpartum recovery rooms, did not have significantly different practices from the mothers in the unexposed group (sleep position and other recommendations). This result may indicate a real effect of the sleeping bag rather than of a culture specific to the network or the maternity hospitals. However, this subgroup was essentially from the same maternity ward, which calls for caution in this interpretation.

Finally, other elements of this type of prevention remain to be investigated: medical-economic aspect of the roll out of embroidered sleeping bags in the maternity hospitals; difficulty managing the material (laundry care, thefts); support for the teams; satisfaction of users and healthcare professionals; sustainability of prevention attitudes throughout the SIDS high-risk period, i.e., the first 6 months of life; impact of infants' way of sleeping where they were initially hospitalized in neonatology, particularly premature newborns who, for the purposes of developmental care, are put in a specific position (sometimes prone, asymmetrical, with a cocoon, etc.).

## 5. Conclusion

Our study confirms that sleeping methods for infants at 1 month of age can often be improved. The effectiveness of a prevention initiative during the stay in the maternity hospital, consisting of using an embroidered sleeping bag with the message “I sleep on my back,” for sleeping newborns is real, with a beneficial impact on the methods of sleeping at home at 1 month of age. This action is complementary to conventional prevention measures, and promotes the messages delivered by professionals.

Not adhering to the sleeping recommendations in the population and the demonstrated effectiveness of preventive initiatives should lead to public authorities advocating for national prevention programs at different levels: information for users before

birth, training for healthcare professionals, rules and regulations to limit the sale of articles and the promotion of risky childcare practices.

In the absence of proactive public policy, perinatal networks can legitimately carry out original initiatives and direct effective prevention programs.

#### Disclosure of interest

The authors declare that they have no competing interest.

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