



Inconsistency Between Pictures on Baby Diaper Packaging in Europe and Safe Infant Sleep Recommendations

Sophie T. Brouard, MSc^{1,2}, Daniel A. Korevaar, MD, PhD³, Christèle Gras-Le Guen, MD, PhD^{1,2,4}, Alix Flamant, MD^{5,6}, Martina Bevacqua, MD^{6,7}, Anna Stanzelova, MD, MSc^{6,8}, Nhung T. H. Trinh, PharmD, PhD⁹, Dalia-Alexandra Ciobanu, MD^{6,10}, Ana Araújo Carvalho, MD^{6,11}, Ifigeneia Kyriakoglou, MD^{6,12}, Maria Fuentes, MD^{6,13}, Yacine Refes, PhD¹, Elisabeth Briand-Huchet, MD¹⁴, Anne-Laure Sellier, PhD¹⁵, Inge Harrewijn, MD¹⁶, Jérémie F. Cohen, MD, PhD^{1,6}, and Martin Chalumeau, MD, PhD^{1,6}

Objective To describe the level of inconsistency between pictures on baby diaper packaging and safe infant sleep recommendations (SISRs) in Europe.

Study design We attempted to identify all packaging of baby diapers sold in 11 European countries for infants weighing less than 5 kg through internet searches from July 2022 through February 2023. For each type of package, we extracted whether there was a picture depicting a baby, whether the baby was sleeping, and whether the picture of the sleeping baby was inconsistent with ≥ 1 of 3 SISRs: (i) nonsupine sleeping position, (ii) soft objects or loose bedding, or (iii) sharing a sleep surface with another person. Data were aggregated at the country level, and a random-effects meta-analysis of proportions was used to obtain summary estimates. The outcome was the summary estimate of the proportion of pictures that were inconsistent with SISRs.

Results We identified 631 baby diaper packaging types of which 49% (95% CI: 42-57; $n = 311$) displayed a picture of a sleeping baby. Among those 311 packages, 79% (95% CI 73-84) were inconsistent with ≥ 1 SISR, including a nonsupine sleeping position, 45% (95% CI 39-51), soft objects or loose bedding such as pillows or blankets, 51% (95% CI 46-57), and sharing a sleep surface with another person, 10% (95% CI 4-18).

Conclusions Pictures on baby diaper packaging in Europe are often inconsistent with SISRs. The prevention of sudden unexpected death in infancy requires action from manufacturers and legislators to stop parents' exposure to misleading images that may lead to dangerous practices. (*J Pediatr* 2024;264:113763).

Sudden infant death syndrome (SIDS) is the sudden unexpected death of an infant (SUDI) of less than 1 year of age that remains unexplained after a complete investigation, including a review of clinical history, an observation of the death scene, and an autopsy.^{1,2} SIDS and “accidental suffocation and strangulation in bed” are the most common causes of SUDI in high-income countries.^{3,4} The prone sleeping position was identified as a major risk factor for SIDS in the early 1990s.⁵⁻⁷ Later, additional risk factors associated with SIDS in relation to the sleeping environment were identified, including a nonfirm sleep surface in a nonapproved crib, soft objects or loose bedding (such as pillows, blankets, bumper-pads), and sharing a sleep surface with another person.^{2,8,9} Conversely, certain protective factors were also identified, such as breastfeeding, sleeping in the parents' room, and the use of a pacifier.^{2,8,10} The “back-to-sleep” prevention campaigns, conducted during the 1990s, led to a 50%-80% drop in SIDS incidence, depending on the country.^{11,12} Since the 2000s, the incidence of SUDI has dropped steadily in most European countries, whereas it has stagnated in other countries and in the United States.^{3,11} Recent evaluations of parental behaviors have shown an increasing inconsistency with safe infant sleep recommendations (SISRs),¹³ reaching as high as 28% and 23% in the Netherlands and the United States, respectively.¹⁴⁻¹⁶

From the ¹Epidemiology and Statistics Research Center, Obstetrical Perinatal and Pediatric Epidemiology Research Team, INSERM, Université Paris Cité, Paris, France; ²CHU de Nantes, INSERM, Department of General Pediatrics and Pediatric Emergencies, CIC1413, Nantes Université, Nantes, France; ³Department of Pulmonary Medicine, Amsterdam University Medical Centers, Amsterdam, The Netherlands; ⁴CHU de Nantes, Department of General Pediatrics and Pediatric Emergencies, Nantes Université, Nantes, France; ⁵Department of General Pediatrics, Cliniques Universitaires Saint-Luc, Brussels, Belgium; ⁶Department of General Pediatrics and Pediatric Infectious Diseases, Assistance Publique-Hôpitaux de Paris, Necker-Enfants Malades Hospital, Université Paris Cité, Paris, France; ⁷Department of Medicine, Surgery and Health Sciences, University of Trieste, Trieste, Italy; ⁸Independent Researcher, Galway, Ireland; ⁹Department of Pharmacy, PharmacoEpidemiology and Drug Safety Research Group, University of Oslo, Oslo, Norway; ¹⁰Children's Hospital “Doctor Victor Gomoiu”, Bucharest, Romania; ¹¹Centro Hospitalar e Universitário de Lisboa Central, Hospital Dona Estefânia, Paediatric Department, Lisboa, Portugal; ¹²Department of Health Sciences, Aristotle University of Thessaloniki, Thessaloniki, Greece; ¹³Department of Pediatric Emergencies, Assistance Publique-Hôpitaux de Paris, Necker-Enfants Malades Hospital, Université Paris Cité, Paris, France; ¹⁴Naitre et Vivre, National Association for the Support of Bereaved Parents and the Fight Against Sudden Unexpected Death in Infancy, Paris, France; ¹⁵HEC Paris, Department of Marketing, Jouy-en-Josas, France; and ¹⁶Department of Neonatal Pediatrics and Intensive Care, Montpellier University Hospital, University of Montpellier, Montpellier, France

EU	European Union
SIDS	Sudden infant death syndrome
SISR	Safe Infant Sleep Recommendation
SUDI	Sudden Unexpected Death in Infancy

Pictures conveying implicit or explicit messages have the potential to actively shape human behaviors, including health-related ones, through the well-known influence mechanisms of authority, social proof, and unity.¹⁷⁻¹⁹ Considerable research demonstrated the impact of pictures on health behavior for the prevention of tobacco use,²⁰⁻²³ alcohol consumption,²⁴ skin cancer,²⁵ and obesity.^{26,27} In the field of perinatal health, studies have shown that pictures may help prevent alcohol consumption during pregnancy, thereby prompting legislative action.²⁸ Another indicator of the persuasive power of images is evident in legislation introduced 10 years ago in Europe to promote breastfeeding. In this legislation, images of infants on infant formula packaging were banned in an effort to prevent the idealization of breast milk substitutes over breast milk.²⁹

Systematic assessments of pictures depicting sleeping babies available in magazines targeted to parents, online and print newspapers, crib displays, commercial stock photography websites, and Instagram have shown alarming levels of inconsistency with SISR, with rates ranging from 35% to 93%.³⁰⁻³⁴ Packaging of childcare items such as baby diapers, wipes, and creams frequently feature images of babies and are repeatedly seen by parents and newborn caretakers. By selecting these baby pictures for their products, childcare manufacturers assume the role of expert authority figures, influencing parents' decisions.¹⁷ As their actions may shape parents' adherence to SISR, it is crucial for manufacturers to set an exemplary standard. In this study, our objective was to provide a description of the level of inconsistency between pictures on baby diaper packaging and SISR in Europe.

Methods

We conducted a systematic assessment of disposable baby diaper packaging sold on the Internet, and in some cases also in physical stores, across a convenience sample of 11 European Union (EU) countries (Belgium, Czech Republic, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Romania, and Spain) between July 2022 and February 2023.

Search Strategy, Selection Criteria, and Data Extraction

Each of the authors (I.H., A.F., M.B., A.S., N.T., D.A.C., A.I.C., I.K., M.F., Y.R., D.K., S.V.) resides in one of the included countries and is a native speaker. Moreover, they possess expertise in the field of pediatrics. They identified disposable baby diaper packaging sold on the Internet within their respective countries, specifically targeting young babies weighing less than 5 kg. This weight limit was chosen to align with the average weight of babies younger than 4 months, 75% of SUDI incidents occurring before this age, with the peak incidence being between 2 and 4 months of age.² Each author systematically used the term "baby diapers" in the language of his/her country on Internet search engines and commercial websites (Table I, available at www.jpeds.com). In

addition, the terms "parent discussion forum" and "online magazines for parents," in the language of each country, were used in Internet search engines. Then, within each free forum and website, we searched for "baby diapers" to identify less common brands potentially missed through initial searches or sold only online. Using the names of these brands, the author went directly to their websites. The results of the searches provided a list of baby diaper packaging, and for each, the author extracted a picture. If the same packaging from the same brand was extracted in several countries with different languages, the picture was included multiple times.

Pictures Analysis

For each package, 2 authors extracted (a) if there was a picture depicting a baby or part of a baby (eg, foot, hands, head), (b) if the baby was sleeping (or possibly sleeping, if the baby's face was not shown), and (c) if the picture of the sleeping baby was consistent with SISR. In cases of disagreement between the 2 authors, a consensus was sought with the help of a third author (M.C.).

Consistency with SISR was based on the 7 dimensions of the 2016 American Academy of Pediatrics' SISR that are also endorsed by most European countries³⁵⁻³⁷: (1) supine sleeping position, (2) a firm sleep surface in, (3) a safety-approved crib (crib, bassinet, portable crib or play yard), (4) room sharing with the parents, (5) no soft objects or loose bedding, (6) not sharing a sleep surface with another person (parents, nonparental caregivers, other children), and (7) pacifier use. As most baby diaper packaging pictures focus on the baby and do not allow the assessment of the firmness of the sleep surface, the adequacy of the crib or room sharing, these recommendations were not considered. Furthermore, because the use of a pacifier is not mentioned in several European recommendations and is a matter of debate,³⁸⁻⁴⁰ this recommendation was also not evaluated. Pictures were considered inconsistent with SISR if one or more of the following 3 criteria were present: (i) nonsupine (ie, prone or side) sleeping position, (ii) soft objects or loose bedding (ie, pillows, pillow-like toys, stuffed toys, quilts, comforters, sheepskins, blankets, nonfitted sheets, or bumper pads), or (iii) sharing a sleep surface with another person. Conversely, pictures were deemed consistent with SISR if they complied with all 3 recommendations.

Statistical Analysis

We performed random-effects meta-analyses to obtain a summary European estimate of the proportion of baby diaper packaging that was inconsistent with SISR, relative to the total number of baby diaper packaging depicting a sleeping baby. In the meta-analysis, each country was considered as a separate "study." To stabilize the variance, the proportions were Freeman-Tukey double arcsine-transformed, following the recommendation by Barendregt et al.⁴¹ The random-effects meta-analyses were performed according to the DerSimonian and Laird method to obtain summary estimates of proportions and their 95% CI.⁴² Forest plots were

used to display the results. The between-country heterogeneity was estimated using the I^2 statistic.⁴³ We interpreted I^2 statistics according to the Cochrane Collaboration's guidance: 30%-60%, 50%-90%, and 75%-100% for moderate, substantial, and considerable heterogeneity, respectively.⁴³ Statistical analyses were performed using the R version 4.1.2 (R Core Team 2022. R: A language and environment for statistical computing. R Foundation for Statistical Computing. URL <https://www.R-project.org/>).

Results

Among the 11 EU countries included in the study, we identified 631 baby diaper packaging types, with a median of 60 unique baby diaper packaging designs per country (ranging from 32 in Ireland to 87 in France). A summary estimate of 82% (95% CI 76-87; $I^2 = 69\%$; $P < .01$) of packages displayed a picture depicting a baby (Table II, available at www.jpeds.com) and 18% did not display a baby. Among the 631 baby diaper packaging types assessed, 31% (95% CI 26-37; $I^2 = 47\%$; $P = .04$) displayed a picture depicting an awake baby. Further, 49% (95% CI 42-57; $I^2 = 73\%$; $P < .01$) of all packaging depicted a picture of a sleeping baby.

Seventy-nine percent (ranging from 68% in Romania to 94% in Spain; 95% CI 73-84; $I^2 = 25\%$; $P = .20$) of the 311 packages depicting a sleeping baby were inconsistent with 1 or more SISRs (Figure 1): non-supine sleeping position 45% (95% CI 39-51; $I^2 = 3\%$; $P = .41$), soft objects or loose bedding, such as pillows or blankets 51% (95% CI 46-57; $I^2 = 0\%$; $P = .96$), or sharing a sleep surface with another person 10% (95% CI 4-18; $I^2 = 68\%$; $P < .01$), with a substantial between-country heterogeneity for the latter (Figure 2; see examples in Table III). The proportion of pictures depicting a sleeping baby sharing the sleep surface with another person ranged from 0% in Greece, Italy and

the Netherlands to 28% in Spain (Figure 2C). Forty-eight percent (95% CI 43-54; $I^2 = 0\%$; $P = .60$) of the 311 packages depicting a sleeping baby were inconsistent with 1 SISR, 28% (95% CI 23-33; $I^2 = 0\%$; $P = .74$) were inconsistent with 2 SISRs, and 1% (95% CI 0-3; $I^2 = 0\%$; $P = .87$) were inconsistent with 3 SISRs (Table IV, available at www.jpeds.com).

Twenty-one percent (ranging from 6% in Spain to 32% in Romania; 95% CI 16-27, $I^2 = 25\%$; $P = .20$) of baby diaper packaging included the picture of a sleeping baby that was consistent with all 3 SISRs (Table IV, available at www.jpeds.com).

Discussion

Among the 311 baby diaper packaging types depicting a sleeping baby identified and assessed in 11 EU countries studied, 79% were inconsistent with ≥ 1 SISR. This is one of the worst rates observed among pictures depicting sleeping babies in parent-focused magazines, online and print newspapers, crib displays, commercial stock photography websites and Instagram.³⁰⁻³⁴ In particular, 45% of all baby diaper packaging showed a baby sleeping in a nonsupine position, which has been confirmed to be a major risk factor of SIDS in a recent meta-analysis, OR 4.9 (95% CI 3.6-6.6),⁴⁴ and the key factor pinpointed as responsible for the decrease in SIDS in the 1990s and early 2000s. The inconsistencies between packaging depicting a picture of a sleeping baby and SISRs were also related to other well-established risk factors for SIDS, such as the use of soft objects or loose bedding, or sharing a sleep surface with another person.^{7,45,46} Only 21% of all baby diaper packaging represented babies sleeping in conditions consistent with all 3 SISRs.

Our goal was to cover all 27 EU countries, but we only invited authors permanently living in 11 of them. These 11

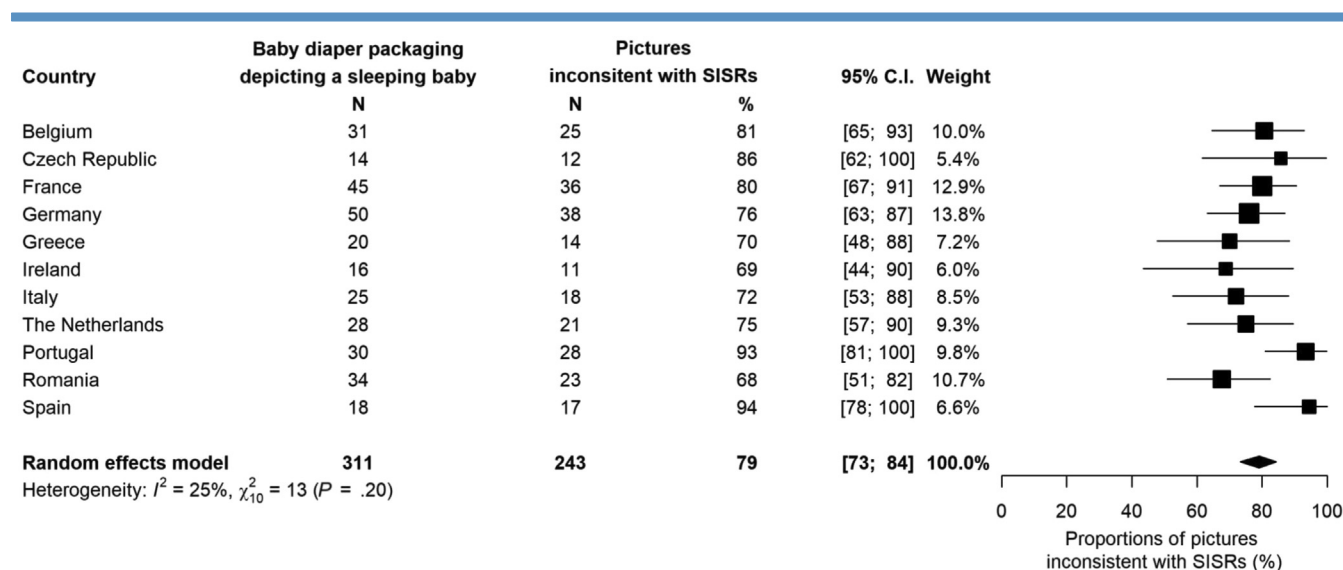


Figure 1. Forest plot of the proportions of baby diaper packaging depicting a sleeping baby that are inconsistent with safe infant sleep recommendations (SISRs) for 11 European Union countries in 2022.

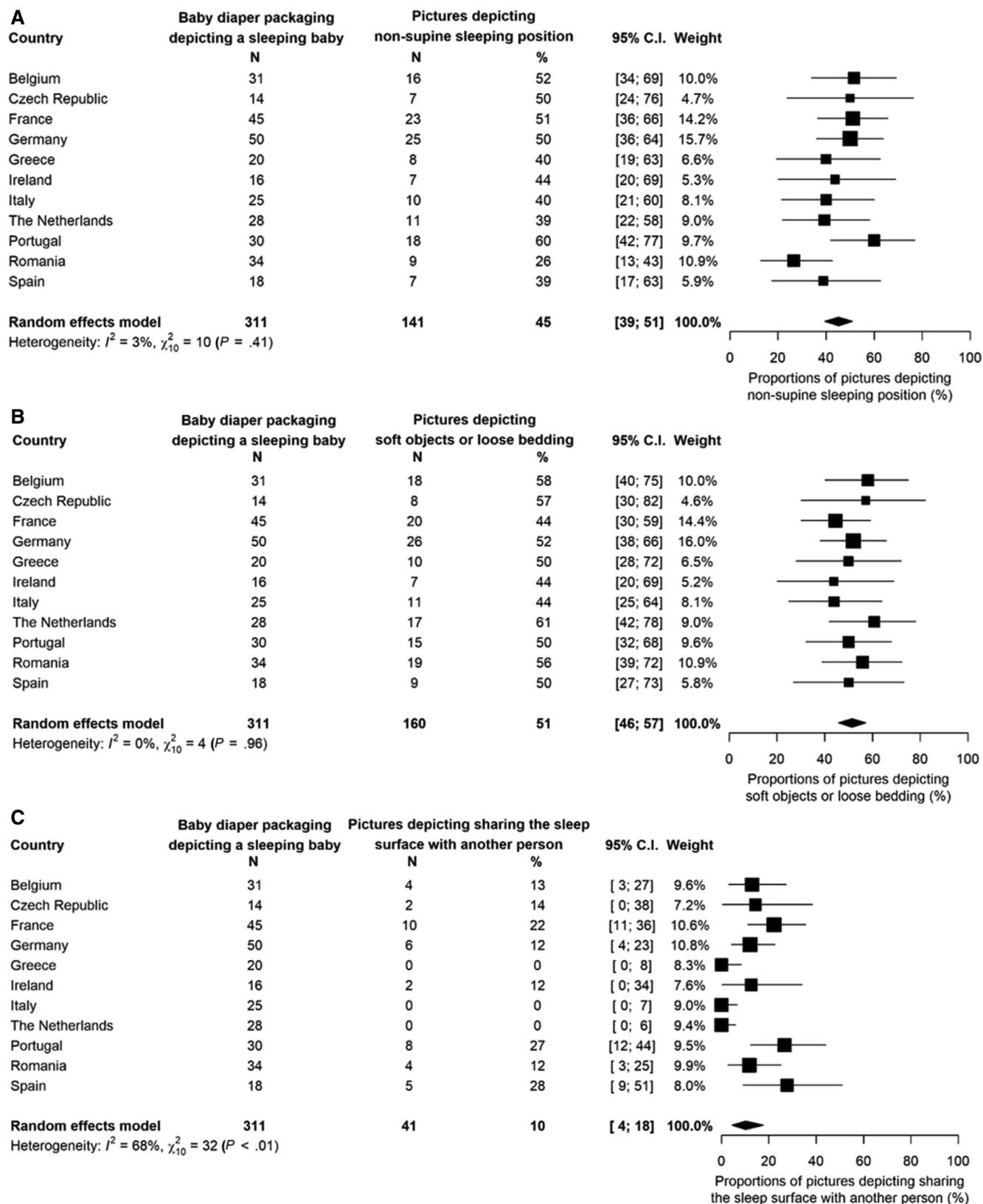


Figure 2. Forest plots of the proportions of baby diaper packaging depicting a sleeping baby that are inconsistent with safe infant sleep recommendations in relation to a prone or side sleeping position (**A**), soft objects or loose bedding (**B**), or sharing a sleep surface (**C**), for 11 European Union countries in 2022.

Table III. Hyperlinks to examples of pictures inconsistent with safe infant sleep recommendations (SISRs) found on websites of baby diaper or mattress catalogs, a food manufacturer, French regulatory and public health agencies, and the Portuguese sudden infant death syndrome (SIDS) prevention program

Websites	Accessed on	Inconsistencies with SISRs		
		Prone or side position	Soft objects or loose bedding	Sharing a sleep surface
Baby diapers catalogues				
https://www.dm.de/babylove-windeln-premium-gr-xs-newborn-xs-bis-3-kg-p4066447093261.html	June, 20 2022	X	X	
https://soysuper.com/p/panales-2-5-kgs-talla-1-paquete-28-uds-baby-smile-1-paquete-28-uds	November, 28 2022	X		
https://www.auchan.fr/auchan-baby-confort-couches-taille-1-2-5-kg/pr-C1158006	June, 13 2022		X	X
https://www.bol.com/nl/nl/p/bambo-babyluiers-prematuur-maat-0-baby-1-tot-3-kg-24-stuks/9300000027411063/?bltgh=jWP9QmZF3NNRZgfPY-BKVQ.2_18.38.ProductImage	January, 22 2023	X	X	
Mattress packaging:				
https://www.candide.fr/nos-produits/le-sommeil/les-matelas-essentiels/190-matelas-essentiel.html	December, 12 2022	X		
French regulatory or public health agencies:				
https://www.economie.gouv.fr/dgccrf/Publications/Vie-pratique/Fiches-pratiques/puericulture-articles	November, 23 2022		X	
https://www.economie.gouv.fr/dgccrf/la-securite-des-articles-de-puericulture-en-question	November, 23 2022		X	
https://www.1000-premiers-jours.fr/fr/le-role-de-lentourage-des-parents	July, 21 2023	X	X	X
Illustration of an article on baby's sleep:				
https://www.bebe.nestle.fr/sommeil-bebe-mois-par-mois	July, 21 2023	X		
Illustration used for the Portuguese national SIDS prevention program:				
http://metis.med.up.pt/index.php/S%C3%ADndrome_da_Morte_S%C3%BAbita_do_Lactente	November, 23 2022	X		

countries represent 77% of the EU population and 81% of its economic gross domestic product. Eastern and Northern Europe were less represented and may have different attitudes toward baby diaper packaging and SISRs. Although it is unclear how this potential bias affected the results, the impact is probably modest because numerous international brands utilized the same pictures across various packaging options in multiple countries included in the study. The generalizability of our results outside the EU is unknown. In an exploratory analysis, we were able to include Norway, a European country that is not a member of the EU, and hence not included in the main analysis. The proportion of pictures depicting a sleeping baby that was inconsistent with SISRs was 100% in Norway, which was higher than the summary estimate for 11 EU countries. Thus, the lack of consistency between baby diaper packaging and SISRs is likely not limited to the EU.

The market share of baby diapers is not publicly available. Therefore, it was impossible to determine the proportion of parents exposed to each brand. To mitigate this limitation, we made a concerted effort to identify as many baby diaper packaging samples sold online, including generic brands. However, we may have failed to identify some packaging because of selection bias inherent in Internet search engines or because the brand was only sold in stores.⁴⁷ We tried to limit potential selection bias by relying on a network of native speakers living across the countries studied. The assessment of the pictures identified (by 2 independent co-authors with expertise in the field of pediatrics) and the statistical approaches used to obtain summary estimates of proportions

and test heterogeneity followed the guidelines for conducting meta-analyses of proportions.⁴¹⁻⁴³ Finally, there are some arguments in the literature for using arcsine-transformed proportions in meta-analyses instead of performing a random-effects logistic model, but the former approach is widely accepted for the type of data used in terms of sample size, number of countries, and number of events.⁴¹

We limited our search to disposable baby diapers because the frequency of purchase of reusable baby diapers and thus the exposure to their packaging is lower and therefore not comparable to that of disposable ones. We also limited our search to the packaging of 1 childcare item, ie, baby diapers, and did not study wipes nor cotton pads. Indeed, the surface of their packaging is much smaller, and brands usually use the same pictures on different products that are aimed at the same target audience.

We deliberately chose to use the 2016 American Academy of Pediatrics recommendations³⁵ because the new ones were published in July 2022,⁴⁸ leaving manufacturers insufficient time to modify their packaging, as our study period ran from July 2022 to February 2023. Furthermore, there was no change between the 2022 and 2016 recommendations regarding the nonsupine sleeping position, soft objects or loose bedding, and sharing a sleep surface with another person.

Finally, it would have been interesting to study the potential correlation between the proportion of pictures that were inconsistent with SISRs or parental behavior and the incidence of SUDI in the studied countries. However, data on

parental behavior are lacking in many studied countries, and we have previously shown a lack of between-country standardization in the definitions of SUDI and SIDS, investigation of SUDI cases, and death certification and coding practices that preclude reliable comparisons.³

Given that 82% of baby diaper packaging in the EU represents a baby, it is highly probable that their manufacturers believe these pictures may impact parents' purchasing behavior. Moreover, 79% of the pictures depicting a sleeping baby were inconsistent with SISRs, so the manufacturer's marketing experts either lack awareness of the importance of SISRs and/or believe that pictures that are inconsistent with SISRs are more attractive. While no statistically significant between-country heterogeneity was observed, the proportions of pictures that were inconsistent with SISRs ranged from 68% to 94%, indicating that, in some countries, some manufacturers may be more aware of SISRs or keener to represent them on baby diaper packaging. In Europe, baby diaper manufacturers are already subject to the European General Product Safety Directive to ensure that these products are safe.⁴⁹ This regulation applies to the baby diapers themselves, but not their packaging, which can convey wrong health messages that can lead to parents using dangerous sleeping practices with their babies. Among the 631 baby diaper packaging assessed, 31% displayed pictures depicting an awake baby and 18% did not display a picture of a baby. These results suggest that for almost half of the baby diaper packages, pictures depicting a sleeping baby are not deemed commercially essential for promoting the sale of baby diapers.

The spreading of misinformation has been listed by the World Economic Forum as one of the main threats to human society.⁵⁰ Whether an information item is considered true by an individual—whether substantiated or not—may be strongly shaped by social norms and whether it is aligned with the individual's belief system.^{51,52} Focusing on pictures of sleeping babies, since online social media cannot be monitored, it is critical that any area/product controlled by childcare manufacturers and public policy makers sends a clear message that is consistent with SISRs. As mentioned above, the EU has previously enacted legislation to promote breastfeeding, following the recommendations of the World Health Organization. The legislation dictates that infant formula manufacturers should not use pictures of babies.⁵³ Therefore, it is conceivable that legislation could be introduced to enforce the exclusive use of images that align with SISRs.

Our results should prompt manufacturers and European legislators to maximize the dissemination of behavior consistent with SISRs. Our recommendation would be to introduce legislation that states that only pictures consistent with SISRs be allowed on childcare items. Given the similar reports for parent-focused magazines, online and print newspapers, crib displays, commercial stock photography websites,³⁰⁻³⁴ and recent findings on the websites of mattress manufacturers, regulatory or public health agencies, and even national SIDS prevention websites in different EU countries (Table III), legislative efforts should have a broader scope

than childcare items and should prohibit all pictures of sleeping babies that are inconsistent with SISRs for commercial and official state communications. Pictures consistent with SISRs would have markedly more influence potential via mechanisms of authority, social proof and unity,¹⁷ particularly in a consumer environment where social media mainly push pictures that are inconsistent with SISRs.³⁴ ■

CRedit Authorship Contribution Statement

Design of the study: Sophie T. Brouard and Martin Chalumeau. Data collection: Inge Harrewijn, Alix Flamant, Martina Bevacqua, Anna Stanzelova, Nhung Trinh, Dalia-Alexandra Ciobanu, Ana Araújo Carvalho, Ifigeneia Kyriakoglou, Maria Fuentes, Daniel Korevaar, Yacine Refes and Sophie T. Brouard. Data analyses: Sophie T. Brouard, Yacine Refes, Jérémie Cohen and Martin Chalumeau. Drafting of the manuscript: Sophie T. Brouard, Jérémie Cohen and Martin Chalumeau. Revising the protocol and critical review of the manuscript: Inge Harrewijn, Christèle Gras-Le Guen, Alix Flamant, Martina Bevacqua, Anna Stanzelova, Nhung Trinh, Dalia-Alexandra Ciobanu, Ana Araújo Carvalho, Ifigeneia Kyriakoglou, Maria Fuentes, Daniel Korevaar, Yacine Refes, Elisabeth Briand-Huchet, Anne-Laure Sellier. Final approval of the version to be published: all authors.

Declaration of Competing Interest

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Reprint requests: Inge Harrewijn, MD, Department of Neonatal Pediatrics and Intensive Care, Centre Hospitalier Universitaire de Montpellier, 191 avenue du Doyen Gaston Giraud, FR-34295 Montpellier, France. E-mail: i-harrewijn@chu-montpellier.fr

Data Statement

Data sharing statement available at www.jpeds.com.

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