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Construction of the Views on Infant Sleep (VNIS) Questionnaire

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ABSTRACT

Parents' beliefs about infant sleep behaviour vary over time and across cultures. No validated instrument exists to understand parents' pre- and postnatal views on infant sleep behaviours, which may influence their caregiving decisions. The Views on Infant Sleep Questionnaire (VNIS) will be a tool to assess parents' beliefs in order to facilitate tailored perinatal care, increase the reliability of postnatal self-report measures, allow for cross-cultural comparisons, and provide a baseline for researchers to use in longitudinal studies. We recruited an online sample of 971 female participants who were resident in the United Kingdom, at least 28 weeks pregnant, and at least 18 years of age. The initial questionnaire consisted of 31 questions about infant independence, night-waking, infant feeding, touch, and safety, and items were rated on a 5-point Likert scale. The item pool was reduced to 12 using principal component analysis and a structure was found for the three components "Closeness", "Independence", and "Night-waking". Overall, these results suggest that the VNIS can provide a brief scale to measure different aspects of individuals' beliefs about infant sleep. In further research the VNIS needs to be validated with a confirmatory factor analysis in another sample, and to be tested as a cross-cultural instrument.

1. Introduction

An infant sleeping separately in their own room, a practice that entails less physical contact and may undermine breastfeeding, is a Western¹ cultural phenomenon [3–8]. In non-Western cultures, co-sleeping is more common, including bed-sharing (where mother and infant sleep on the same sleep-surface) and room-sharing (where mother and infant sleep in the same room but on separate sleep-surfaces) [9,10].

Parental decisions around infant sleeping location, feeding method, night-time independence, and physical closeness are attributable to underlying cultural beliefs about infant sleep and night-time care [2,9,11–15]. Research suggests that newborn infants' sleep occurs in 2–3 h bouts throughout a 24-h period [16], which is important for memory [17] and brain development [18]. However, many Western parents expect infants to sleep independently through the night from a

young age [3]. This is sometimes attributed to Moore and Ucko's study in 1957, which reported that 70 % of infants had started sleeping through the night by the age of three months and pathologized infant night waking [3,19–21].² More recently, a review paper reported risk factors for infant sleep 'problems' (including night-waking) to include bedtime nursing, close contact, and co-sleeping [22]. It is therefore important to consider the cultural context in which parents make their caregiving decisions, including their underlying beliefs about infant sleep [3].

There is evidence that, for Western parents who bed-share, the majority of the time it is unplanned [23]. Although in the United Kingdom (UK) it is estimated that between 46 % and 70 % percent of parents bed-share [8,24–27],³ Ball et al. [25] found that no parents had planned to bed-share prior to their infant being born. Until recently, bed-sharing was discouraged by UK public health bodies [29]. Safety concerns are one reason why parents may plan for solitary infant sleep or room-

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¹ For the concept of "Western", as commonly used in the literature to date, see Henrich et al.'s description: "Western, Educated, Industrialized, Rich, and Democratic" [1]. However, differences also exist within Western cultures, e.g., between Anglophone and non-Anglophone cultures [2].

² Moore & Ucko's findings were self-reinforcing in two ways: (i) the infants were formula-fed, so the higher fat content of formula would have meant they awoke less frequently to feed; and (ii) by being in a separate room, parents may have been unaware of some of their infants' night-wakings [3].

³ There is variation in how bed-sharing is defined, leading to large differences in the reported rates [28].

sharing instead of bed-sharing [23]. However, UK guidance has changed in light of evidence suggesting no increased risk of Sudden Infant Death Syndrome (SIDS)⁴ when bed-sharing in the absence of hazardous circumstances [31–33]. Many of the hazardous circumstances can be avoided with planning, including ensuring that no one sharing a bed with the baby has drunk alcohol or taken drugs [34]. Given the higher risk associated with unplanned bed-sharing [34], it is important to understand whether parents' views and expectations about infant sleep can predict their caregiving decisions.

Existing questionnaires on infant sleep are not designed for prenatal use [4,35,36]. Moreover, they do not consider cross-cultural variations in parents' views on infant sleep [35,37]. For example, a widely-used scale for assessing infant sleep is the Brief Infant Sleep Questionnaire (BISQ) [36], which can be scored by clinical interpretation [38] or by using a norm-referenced scoring system based on data collected in the United States [35]. As the authors of the scoring system note, one limitation is cross-cultural differences in the perception of infant sleep problems [35]. In another example, the Maternal Cognitions about Infant Sleep Questionnaire [39] has a cultural bias towards infant independence, e.g., the item “I am able to resist my child's demands when he/she wakes at night” is scored such that a parent responding to their infant's needs would be classed as unable to set appropriate limits. Therefore, the Views on Infant Sleep Questionnaire (VNIS) aims to fill these gaps by wording items neutrally, so that the questionnaire may be used cross-culturally. The wording is also temporally neutral to allow the VNIS to be used both pre- and postnatally. Ultimately, the VNIS can be used alongside other measures to examine correlates of parents' beliefs about infant sleep, and to examine how these views change over time.

The aims of this study were: (i) to construct the VNIS questionnaire, which considers prospective parents' beliefs about infant sleep; and (ii) to find a salient factor structure and reduce the number of questions that we had originally created. We plan to validate the results of this exploratory study via confirmatory factor analysis in a later study.

2. Methods

2.1. Participants

We recruited participants who met the inclusion criteria of being at least 28 weeks pregnant, at least 18 years of age, and resident in the UK.⁵ Recruitment methods comprised Twitter/X, Facebook, Instagram, Call for Participants (an online recruitment platform), flyers posted in the local area, and through a gatekeeper at local children's centres in Liverpool, UK. As part of the recruitment strategy, we told participants they could optionally provide their email address at the end of the survey for a chance to win one of two £25 shopping vouchers. A total of 1058 responses were recorded and we performed casewise deletion of missing data, which gave us usable data for 971 female participants. The mean age of participants was 28.62 years old ($SD = 6.00$; range = 18–62).⁶ We collected data between October 2022 and August 2023.

2.2. Ethics

The study was approved by Liverpool John Moores University Research Ethics Committee and followed the Helsinki Declaration

⁴ SIDS is defined as, “The sudden unexpected death of an infant <1 year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history” [30].

⁵ Based on self-report.

⁶ We tested whether excluding the 12 participants who were age 45 or older changed the component structure, and it did not.

guidelines [40]. All participants provided informed consent to participate before completing the questionnaire. Participants' data were collected anonymously and their IP address was not recorded. Participants were able to withdraw from the study at any time by closing their browser window; however, they were informed that any data collected up to that point could not be withdrawn. At the end of the study, participants were debriefed and signposted to resources on safer sleep. Participants were invited to follow an optional link to enter a prize draw and provide their email address, which was not linked to their survey responses.

2.3. Materials

We created 31 questions about infant night-time independence, infant feeding method, physical closeness, infant sleeping location, night-waking, and infant sleep physiology by considering other questionnaires related to infant night-time behaviour and identifying areas where those scales were lacking.⁷ IB, SR, TS, and HB reviewed the questions to check face validity, content validity, and ease of comprehension. The level of expertise of the research team ranged from doctoral student to full professor and their backgrounds included psychology, midwifery, and anthropology. As a result of this review, the wording of some items was changed. The response scale for all items was a 5-point Likert scale (“Agree strongly” = 1, “Agree” = 2, “Neither agree nor disagree” = 3, “Disagree” = 4, “Disagree strongly” = 5). Reverse-scored items, which emphasised infant independence, physical distance, or reflected less knowledge of infant sleep physiology, were recoded. The complete set of questions is provided on the Open Science Framework, OSF (<https://osf.io/gqamz/>).

2.4. Procedure

The data were collected online via Qualtrics (Qualtrics, Provo, UT, USA). Participants accessed the survey on Qualtrics by following a link (online methods) or scanning a QR code (flyers). The link/QR code led to a participant information sheet. Only after providing informed consent and affirming that they met the inclusion criteria could participants access the questionnaire on the next pages. We asked for demographic information (age and first half of UK postcode), which were optional questions. Subsequently, 31 questions were displayed as a series of 6 pages with 5 to 6 items per page. The items were presented in the same order for every participant. At the top of each page, participants were instructed to select a response to indicate how much they agreed or disagreed with each statement. It was highlighted that questions referred to infants who were newborn up to twelve months old. Participants were assured that all data were collected anonymously and could not be traced back to individual responses. Upon completing the survey, participants were debriefed on the last page which further explained the purposes and background of the study and provided links to The Lullaby Trust and the UK's National Health Service (“Caring for a Newborn”). Following this, participants were offered entry into an optional prize draw, which redirected them to a different survey to collect their email addresses. As this was a separate survey, it was not linked in any way to their questionnaire responses. The prize draw winners were chosen using a random number generator and the sort function in Microsoft Excel for Mac (Version 16.77) [41] and the winners were notified about the shopping vouchers by email. Participant contact details (the email addresses) were then deleted.

2.5. Preprocessing

Preprocessing was performed using R Statistical Software Version 4.1.2 [42] and the readxl [43], janitor [44], and dplyr packages [45]. Of

⁷ As noted in the introduction.

the $N = 1058$ survey responses, casewise deletion was performed for participants who reported their age to be <18 , and for participants with any unanswered Likert-type questions.⁸ The number of usable observations was 971.

2.6. Data analysis

We used R Statistical Software Version 4.1.2 [42] and the psych [46] and GPArotation [47] packages for our data analyses. We performed Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin test of sampling adequacy to ensure the data were fit for factor analysis. Following this, we used a scree plot to determine the number of components to retain [48], then we performed two principal component analyses, first using all 31 questions, then using the 12-item version. Subsequently, we measured the internal consistency of each of the three components using Cronbach's alpha and McDonald's omega. All materials, data, and code have been made publicly available and can be accessed on the OSF page: <https://osf.io/gqamz/>.

3. Results

Bartlett's Test of Sphericity was significant ($\chi^2 = 15,325.00$, $df = 465$, $p < .001$) and the Keyser-Meyer-Olkin test of sampling adequacy value was 0.97, indicating that the dataset was fit for factor analysis.

We performed a principal component analysis (PCA) using an oblimin (oblique) rotation. We chose PCA in order to reduce the number of items, and because the theoretical constructs underlying the VNIS were believed to be interrelated [49]. According to the scree plot (Fig. 1), we selected a three-component solution for detailed analysis. Interpreting the diagram (Fig. 2), we retained items based on their component loadings, and how theoretically related they were to other items loading on the same components. Additionally, we removed two items that were similar to another item in the same component (item 9) or, in retrospect, logically ambiguous (item 31). Inconsistent with predictions, there were not specific components for infant feeding and safety. In fact, infant

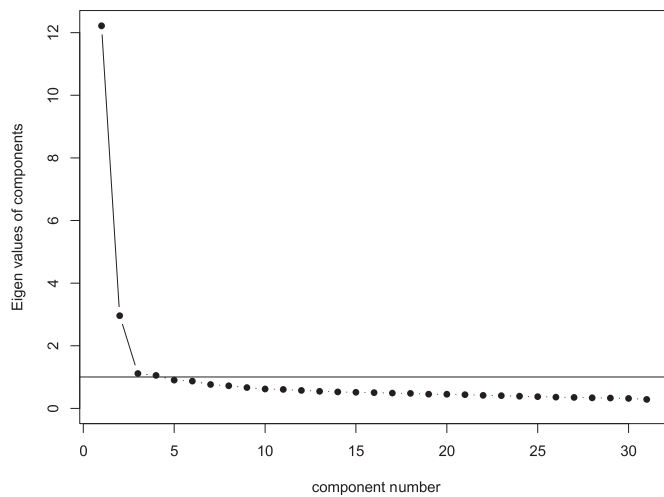


Fig. 1. Scree plot for the original 31 items in the VNIS Questionnaire. Note. The horizontal line $y = 1$ indicates Eigenvalues of 1. The point at which the Eigenvalues begin to level off is at $x = 3$ components; hence, we retained three components.

⁸ We deleted the data of participants who reported their age to be <18 because age was one of the inclusion criteria. Deleting their data did not change the results.

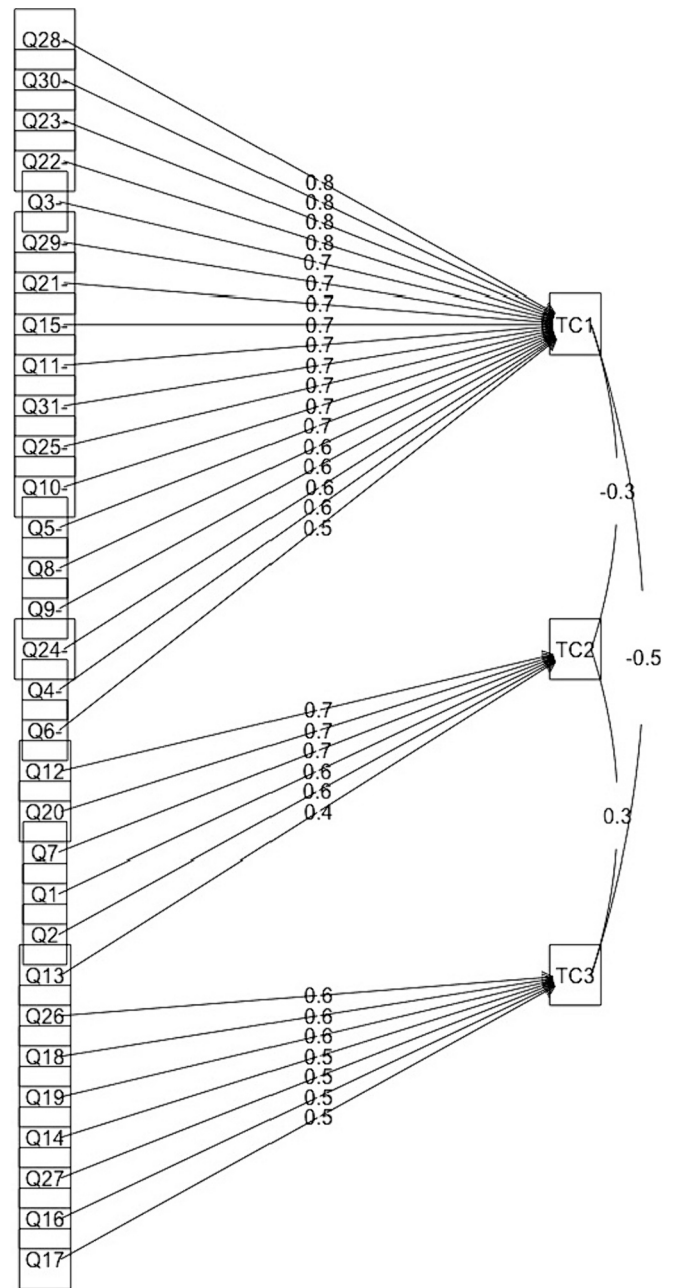


Fig. 2. Component structure of the original 31 items showing loadings onto the three components TC1 (“Closeness”), TC2 (“Independence”), TC3 (“Night-waking”).

feeding questions loaded onto several different components and we determined that removing items related to infant feeding allowed for better interpretation of the component structure.

The solution comprised three components which we named: “Closeness”, “Independence”, and “Night-waking”, with four items in each component. The component structure is presented in Table 1, and the 12-item VNIS is presented in Appendix A. The component “Closeness” related to maintaining proximity to the infant: “During human evolutionary history, infants usually slept next to their mothers”, and “It’s normal for a mother to feel anxious if she is separated from her infant at night” present views that promote keeping mother and infant close during the night. Two items related to safety also loaded highly on this component: “All pregnant women should plan how they would share a bed safely with an infant, in case they fall asleep together

Table 1
VNIS component structure.

	Component		
	TC2	TC1	TC3
	Independence (0.36)	Closeness (0.33)	Night-waking (0.31)
During human evolutionary history, infants usually slept next to their mothers. (Q1)	0.14	0.60	0.31
All pregnant women should plan how they would share a bed safely with an infant, in case they fall asleep together accidentally. (Q2)	-0.14	0.81	-0.12
Moving an infant to their own room at 6 months of age means that the parents can sleep better. (Q5 R)	0.64	-0.16	-0.05
Sleeping on a sofa or armchair with an infant is unsafe. (Q7)	0.05	0.73	0.03
During the first few months of life, most infants sleep in bouts of two to three hours. (Q16)	-0.08	0.00	0.80
Infants need to feed frequently during the night because their brains are growing quickly. (Q17)	-0.23	0.26	0.46
An infant's ability to wake easily during the night decreases the odds of Sudden Infant Death Syndrome. (Q19)	-0.22	0.17	0.51
It's normal for a mother to feel anxious if she is separated from her infant at night. (Q20)	0.04	0.67	0.18
An infant who doesn't sleep through the night by 6 months of age has a sleep problem. (Q22 R)	0.78	-0.19	0.11
Some infants have never slept through the night by one year of age. (Q26)	0.04	0.00	0.85
Infants whose parents soothe them when they wake at night will never learn to be independent. (Q29 R)	0.81	0.07	-0.08
A mother teaches her infant to be strong by letting them cry at night. (Q30 R)	0.83	0.15	-0.09

Note. Numbers in parentheses after the component names are the proportion of variance explained by each component. The other table values represent the standardised loadings based upon the correlation matrix. "R" indicates a reverse-scored item. Bold font indicates that an item loads highly on a particular component. The question numbers are indexed from the original 31 questions, which can be found at <https://osf.io/gqamz/>.

accidentally", and "Sleeping on a sofa or armchair with an infant is unsafe", recognising the importance of planning in reducing SIDS risk.

The second component was "Independence", which was characterised by an infant's conforming to their parents' schedule, rather than vice-versa. This concept is reminiscent of the distinction between "facilitator" and "regulator" mothers proposed by Raphael-Leff [50], where facilitator mothers adapt to their infants, while regulator mothers expect their infants to adapt to them. All of the items on this component were reverse-scored. It was predicted that prospective parents with a more Western view, valuing infant night-time independence, would welcome the belief that "Moving an infant to their own room at 6 months of age means that the parents can sleep better (R)". Similarly, it was thought that a parent valuing their own night-time independence would believe that "An infant who doesn't sleep through the night by 6 months of age has a sleep problem (R)". Similarly, it was hypothesised that a parent with this view might also believe that "Infants whose

parents soothe them when they wake at night will never learn to be independent (R)" and "A mother teaches her infant to be strong by letting them cry at night (R)".

The third component, "Night-waking", assessed prospective parents' beliefs about infant sleep physiology, with the items "During the first few months of life, most infants sleep in bouts of two to three hours"; "Infants need to feed frequently during the night because their brains are growing quickly"; "An infant's ability to wake easily during the night decreases the odds of Sudden Infant Death Syndrome"; and "Some infants have never slept through the night by one year of age".

After the item pool had been reduced to 12, the PCA was re-run to examine if the component structure remained the same. Although the component loadings differed slightly, the three-component structure remained the same (Fig. 3). Following this, we tested the internal consistency of each component using both Cronbach's alpha and McDonald's omega and found good values of these indices for all of the components ("Closeness": $\alpha = 0.75$ and $\omega_h = 0.73$; "Independence": $\alpha = 0.80$ and $\omega_h = 0.79$; "Night-waking": $\alpha = 0.78$ and $\omega_h = 0.75$).

4. Discussion

In this study, we aimed to construct the Views on Infant Sleep (VNIS) questionnaire and find a robust component structure. We began with 31 questions and reduced this into a 12-item scale with three components ("Closeness", "Independence", and "Night-waking") which may reflect underlying beliefs about infant sleep behaviour. The component "Closeness" relates to proximal night-time care, and it is important to consider the evolutionary and cultural context in which this takes place. The item "During human evolutionary history, infants usually slept next to their mothers" is likely to prompt beliefs about whether bed-sharing is appropriate. From an attachment perspective, an infant's desire to maintain proximity to their mother is an evolutionary adaptation to promote survival [51]. Furthermore, parents reciprocate their infant's attachment behaviours by providing protection (or withdrawing it, in the case of attachment avoidance) [52,53]. However, in Western cultures, a mother's instinct to respond to an infant's call to be soothed may be pathologized as an inability to maintain appropriate boundaries [37].

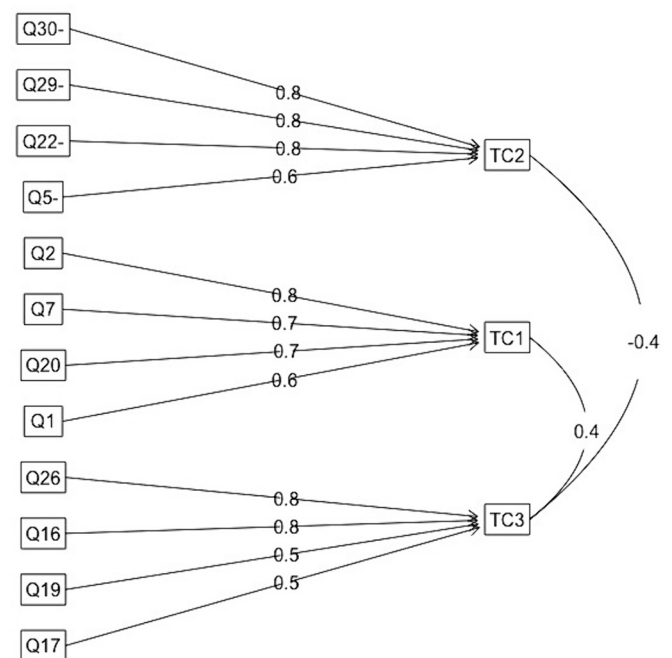


Fig. 3. Component structure of the 12-item VNIS showing the loadings onto the three components TC1 ("Closeness"), TC2 ("Independence"), TC3 ("Night-waking").

Therefore, “It’s normal for a mother to feel anxious if she is separated from her infant at night” represents a less mainstream-Western view as it relates to a mother’s instinct to maintain proximity. Interestingly, two items related to safety also loaded on “Closeness”, and this may reflect a general acceptance of proximal sleep. For example, “All pregnant women should plan how they would share a bed safely with an infant, in case they fall asleep together accidentally” acknowledges that bed-sharing may occur. This is in contrast to some Western medical advice that historically banned bed-sharing [29]. Similarly, “Sleeping on a sofa or armchair with an infant is unsafe” reflects nuanced knowledge of safe sleep guidance, which may indicate that the participant has been educated about different levels of risk associated with different sleeping arrangements.

The component “Independence” reflects dominant Western views promoting night-time independence and comprised reverse-scored items. Participants scoring high on independence-related items scored lower on “Closeness”, showing an inverse relationship between the constructs of independence and proximal care. Finally, the component “Independence” also showed an inverse relationship with the component “Night-waking”, demonstrating that participants who expect infants to wake during the night are less likely to expect infant night-time independence. Moreover, the items reflect parental beliefs that waking could be advantageous for reasons including feeding and safety. To wit, it has been suggested that some SIDS cases may result from an infant’s inability to wake after brief apnoeas, known as “arousal deficiency” [54]; however, a mother’s physical night-time presence may contribute to the development of an infant’s ability to arouse after an apnoea, demonstrated by a greater arousal frequency in bed-sharing infants [55].

Although the original item pool contained items on independence, night-waking, infant feeding, touch, and safety, these were not all found to be salient components. In particular, it was necessary to remove items on infant feeding to find a robust component structure. This may reflect diverse attitudes about breastfeeding in this UK sample. In context, although approximately 72 % of mother-infant dyads initiate breastfeeding in England [56], rates fall steeply thereafter, with less than half of infants partially or fully breastfed by 6 to 8 weeks postpartum [57]. Moreover, rates vary by ethnicity and social class. Kelly et al. [58] reported that in the UK, breastfeeding rates were lowest among white mothers and highest among Indian, Pakistani, Bangladeshi, black Caribbean, and black African mothers. Additionally, adjusting for socio-demographic characteristics, Peregrino [59] found that breastfeeding initiation was 40 % less likely in mothers living in deprived areas of the UK. Breastfeeding is therefore a complex variable which may have added noise to the original 31 questions, necessitating the removal of infant feeding questions.

Generally, differences in parental views about closeness, independence, and night-waking have not been explored in their own right in a questionnaire, although they are latent variables that may lead to parental caregiving decisions relating to infant night-time sleep location. Unlike other questionnaires, the VNIS does not take a specific Western (or non-Western) stance on these variables, which is evident in the language used to describe the components. For example, “Independence” can be viewed positively or negatively depending on one’s views about infant night-time care. Contrasting with a different questionnaire, e.g., the factors “Doubt” and “Limit setting” (or lack thereof) imply “impairments” [37], which typifies a Western tendency to pathologize infant sleep and parental night-time caregiving [20,21]. This study’s analysis also provides preliminary evidence of a component structure which can be validated in future studies. In contrast, the BISQ relies either on clinical interpretation [36,38], or can be used with a norm-referenced scoring system which carries a Western bias [35]. Moreover, we do not know of any questionnaires specifically designed to assess parents’ views prenatally. Therefore, the VNIS advances the current research in this area by providing a short, 12-item, openly available scale to explore parents’ pre- and postnatal views on infant sleep.

In future research, these findings need to be validated through

confirmatory factor analysis. Moreover, the results indicate that the three components identified (“Closeness”, “Independence”, and “Night-waking”) may reflect beliefs about night-time infant care in a UK sample. However, it is important to compare parental views on these constructs using other samples from different cultures. For example, participants from the United States might respond differently to the second item, “All pregnant women should plan how they would share a bed safely with an infant, in case they fall asleep together accidentally” because the US guidelines advise against bed-sharing [60]. Similarly, we acknowledge that the scale is unable to differentiate between participants’ beliefs and knowledge. For example, a participant’s response to the first item, “During human evolutionary history, infants usually slept next to their mothers”, could reflect a lack of knowledge, i.e., they have never thought about human evolutionary history in the context of infant sleep and therefore do not have an opinion. However, it would be interesting to know how mothers from different cultures responded to this example. In doing so, the VNIS could potentially provide a baseline to understand how cross-cultural sleep practices contribute to mother-infant well-being. For example, further research is needed as to whether parents who expect frequent night-waking plan for a more proximal sleep location. It has also been suggested that when infant sleep practices align more closely with one’s cultural norms (e.g., bed-sharing in non-Western cultures, as opposed to bed-sharing in Western cultures), parents perceive infant night waking as less problematic and this may have a protective effect on maternal emotional wellbeing [11]. Therefore, cross-cultural data collected using the VNIS could potentially allow for these relationships to be explored further.

In summary, the 12-item VNIS may potentially be used to assess parents’ views related to closeness, independence, and night-waking. However, confirmatory factor analysis is needed to validate these findings, and further research would benefit from cross-cultural comparisons.

Open practices

All materials, data, and code have been made publicly available and can be accessed on the OSF page <https://osf.io/gqamz/>.

CRediT authorship contribution statement

Ingrid Boedker: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Helen L. Ball:** Supervision, Writing – review & editing. **Michael Richter:** Data curation, Formal analysis, Supervision, Writing – review & editing. **Tina L. South:** Supervision, Writing – review & editing. **Sam G.B. Roberts:** Supervision, Writing – review & editing.

Declaration of competing interest

Helen Ball serves as Chair of Grants Committee and Member of Scientific Advisory Board for Lullaby Trust (unpaid); Member of Qualifications Board and ad hoc advisor on infant sleep for Unicef UK Baby Friendly Initiative (unpaid); advisor on infant and child sleep for TUSLA (Ireland’s child care regulator, unpaid); Associate Editor, *Sleep Health* academic journal, Elsevier Publishers (unpaid). She currently holds research funding from Northumberland County Council, Durham County Council, the Northern Accelerator, and Durham University. The other authors have no competing interests to declare.

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decision to submit the article for publication.

Appendix A. 12-Item VNIS

Instructions: For each of the questions below, please select a response to indicate how much you agree or disagree with it. The questions ask about infants who are newborn up to twelve months old.

[5-point Likert scale: “Agree strongly” = 1, “Agree” = 2, “Neither agree nor disagree” = 3, “Disagree” = 4, “Disagree strongly” = 5.]

N.B. Numbers are indexed from the original 31 questions for reference.

Closeness – 4 items

- 1-During human evolutionary history, infants usually slept next to their mothers.
- 2-All pregnant women should plan how they would share a bed safely with an infant, in case they fall asleep together accidentally.
- 7-Sleeping on a sofa or armchair with an infant is unsafe.
- 20-It's normal for a mother to feel anxious if she is separated from her infant at night.

Independence – 4 items

- 5-Moving an infant to their own room at 6 months of age means that the parents can sleep better. (R)
- 22-An infant who doesn't sleep through the night by 6 months of age has a sleep problem. (R)
- 29-Infants whose parents soothe them when they wake at night will never learn to be independent. (R)
- 30-A mother teaches her infant to be strong by letting them cry at night. (R)

Night-waking – 4 items

- 16-During the first few months of life, most infants sleep in bouts of two to three hours.
- 17-Infants need to feed frequently during the night because their brains are growing quickly.
- 19-An infant's ability to wake easily during the night decreases the odds of Sudden Infant Death Syndrome.
- 26-Some infants have never slept through the night by one year of age.

N.B.: Each respondent's score is a sum of their ratings for each component: Closeness (potential range of scores 4–20); Independence (4–20); and Night-waking (4–20). The possible range of scores for the total questionnaire is 12–60.

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