Parenting in a digital era: An evaluation of parenting websites and applications about infant sleeping and crying problems

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Abstract

In the present study we evaluated parenting websites and applications that provide advice to parents about treating and preventing infant sleeping and crying problems. The parenting websites and applications were evaluated based on the information they provided and on whether an expert had contributed in the making of the content. We used the same methodology that was used in similar studies and we created two evaluation forms: one to assess the information provided and one to assess the contribution of an expert in the making of the content. Our data showed that the content of all of the parenting websites and applications we evaluated was poor. However, we obtained varied results in relation to the contribution of an expert in the making of the content. In relation to the websites, the majority of the websites we evaluated had poor expert contribution, four had fair expert contribution, one had good expert contribution and four had excellent expert contribution. In relation to the applications from the Play store, only one application had excellent expert contribution, while the remaining 14 had poor expert contribution. Similarly, in relation to the applications from the App store, only one application had excellent expert contribution, while the remaining 16 had poor expert contribution. Our findings suggest that developers and publishers should pay more attention to the content of the products they make and ensure that the information they use is evidence-based. Parents of infants should also be informed about the importance of identifying trustworthy health-related information online.

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Introduction

Infant sleeping and crying problems are the most common source of concern and distress for new parents. Studies have found that 59% of new parents think that their infant's sleep is problematic (Tsai, Lee, Chen & Tung, 2018), while 45% of mothers and 59% of fathers report that sleep is their infant's primary problem (Smart & Hiscock, 2007). Similarly, 42% of mothers and 37% of fathers consider crying the most important problem of their infants (Smart & Hiscock, 2007). Especially infants who wake up during the night and cry can create discomfort to their parents who usually stress over this situation.

Traditionally, parents would seek advice from professionals to deal with problems that are related to infant sleeping or crying problems. In one study, 45% of mothers of infants reported that they seek advice in relation to infant sleeping and crying problems from pediatricians and 47% from books or other printed sources (Smart & Hiscock, 2007). Other sources that mothers turn to for advice are their mothers (41%) or other relatives (36%) (Smart & Hiscock, 2007).

However, over the last years there seems to be a tendency for parents to turn to online sources to retrieve health-related information. Lupton and Pedersen (2016), found that 49% of the mothers that had given birth the last 3 years had used a parenting application. What is more, 19% of the mothers are using parenting applications daily and 20% every week (Lupton & Pedersen, 2016). Mothers in the United States spend approximately 4 hours daily searching online information (Daily U.S. mom media usage 2017, May 2017). In the Dutch population, almost 87% primarily used the Internet to find health-related information (Van de Belt, Engelen, Berben, Teerenstra, Samsom & Schoonhoven, 2013). At the same time the number of parents who have internet access or own a smartphone, tablet or mobile phone is increasing. In the United States 86% of the mothers own a smartphone and 65% a tablet (Daily U.S. mom media usage 2017, May 2017). Similarly, almost 82% of the Dutch population used mobile internet on a smartphone, laptop or tablet throughout 2018 (Did you use mobile internet on a device in the past 3 months?, 2018).

These data suggest that there is a need to assess whether the information parents obtain online or through digital applications is evidenced-based. This is extremely important especially when we are referring to health-related information about infants. Some studies have already focused on this topic. Scott, Gome, Richards and Caldwell (2014) conducted research to examine the trustworthiness of the information provided in parenting applications.

They evaluated 10 free digital applications about children's health that were popular on Android and iOS devices. The results showed that the technical aspects (functionality, security and usability) and the content (evidence-based information and expert contribution) of all the applications that were evaluated were unsatisfactory. In fact, they found significant differences in terms of security, evidence-based information and expert contribution in creating the content. Of the 10 applications that were evaluated, only four had recruited a health-care professional in creating the content, while for the remaining six it was unclear whether there was expert contribution or not. Two of these applications were from the Play store and two from the App store. Similarly, only four applications presented evidence-based content and six did not use references or links to the original health articles. Of the four applications providing evidence-based content, three were from the Play store and one from the App store.

Davis, Logsdon, Vogt, Rushton, Myers, Lauf and Hogan (2017) also conducted a study where they evaluated 46 parenting applications. They used two criteria: the Patient Education Materials Assessment Tool (PEMAT) and the recommendations of a national consortium called Trust it or Trash it. The PEMAT tool assesses whether health information is understandable and actionable. The Trust it or Trash it criterion evaluates the information provided based on three questions: who said it, when did he say it and how did he know. The results showed that the majority of the applications did provide a link to the medical articles or websites related to the topics discussed in the applications. However, 23% of the applications did not provide a reference for the information they presented. The information provided in 30 of the applications, obtained a score between 76-100% on the understandable scale showing that the information in these applications is quite easy to understand. In contrast, only 19 of the applications obtained a score higher than 76% on the actionable scale. The actionable scale measures whether people with different backgrounds and health literacy levels can understand how to use the information they read. This result showed that more than half of the applications failed to provide information that can be used by the entire population. This could potentially create a problem for parents of infants who are not able to understand and correctly use the information obtained through these media.

Zhao, Freeman and Li (2017) assessed the quality of Chinese infant feeding applications. In total they evaluated 26 applications. To evaluate the applications they created an assessment tool divided in four categories: accountability, scientific basis, advertising policy and functionality. In addition, they used semi-structured interviews with mothers of infants. Results from the evaluation with the assessment tool showed that only one

application named the author of the provided information and his affiliations. What is more, none of the applications presented the author's educational background or his/her professional affiliations. In relation to the evaluation of the scientific basis only three applications provided all three of the recommendations of the World Health Organization for infant feeding. The rest of the applications only provided one or two of the recommendations or a combination of two. Results from the interviews showed that 12 of the 21 mothers that participated in the study, were interested in finding the source of the information in the application. However, 10 of the mothers stated that they did not completely trust the information in the application. These mothers were getting information in relation to infant feeding from peers, elders, books and applications. They reported that in case of conflicting information from the application and from the peers, elders and books they were trying to make a decision on their own.

Taki, Campbell, Russell, Elliott, Laws and Denney-Wilson (2015) also evaluated the credibility and reliability of the information provided in applications and websites in relation to infant feeding. They used two existing tools (Health-Related Website Evaluation Form and the Quality Component Scoring System) as well as one tool that they developed themselves, which assessed the quality, comprehensibility, suitability and readability of the applications and websites. In total, they evaluated 44 websites and 46 applications. The quality results showed that 11 of the websites presented the author's qualifications, nine presented the author (who was a health-care professional) and two had a parent and a journalist as authors. Ten of the applications also presented the author's qualifications, four of whom were health-care professionals while six had no health-care experience. Overall, the websites provided more information in relation to infant feeding and had a bigger variety of topics than the applications. However, in two of the websites the information provided was inaccurate.

Thus, it becomes clear that before using parenting applications or parenting websites it is important to assess whether the information is evidence-based and whether the author's name, qualifications and credentials are stated. However, many parents do not check if the source of the information provided in digital applications or online websites is evidence-based. In fact, it was found that 68% of parents have never checked if the information they are using is evidence-based and only 8% have reported that they are checking the source of the information for every digital application they are using (Lupton and Pedersen, 2016).

In the present study, we will investigate whether the information provided in parenting applications and websites is evidence-based. Before we start with our analysis, we will present evidence-based practices that help parents manage infant sleeping and crying problems. The methods and techniques used in these interventions will form the basis of the criteria that we will use for the content evaluation of the parenting websites and applications later.

Literature review of the effective interventions for preventing and treating infant sleeping and crying problems

The interventions used to prevent and/or treat infant sleeping and crying problems are usually called educational/behavioral interventions and are aimed at altering the strategies parents follow and subsequently alter the infant's sleeping or crying behavior. Parents participating in these interventions usually receive training in group or individual sessions. The aim of these sessions is to train parents on how to use different strategies to manage infant sleeping and/ or crying problems. In some cases the sessions are reinforced with follow up support calls from experts or with the distribution of hard copies, leaflets, DVDs or supplementary websites where parents can find more information on the topics discussed in the sessions.

Symon and Crichton (2017) examined the effectiveness of a training program for parents to improve infant sleep. They recruited infants aged 6-12 months along with their parents. Parents participated in 45-minute sessions with a general practitioner or a nurse trained and supervised by the practitioner. The main topic of the sessions was that uninterrupted sleep is a learned behavior. The practitioner and the nurse encouraged parents to establish bedtime routines for their infants, track their infants sleep using sleep diaries and suggested putting the infant to sleep while still awake. After the sessions, participants received a hard copy with all the information discussed in the sessions. A website was also available with additional information. The results of the intervention showed that infant sleep improved. The minimum and maximum times of night awakenings were decreased (from 3.3±2.2 times to 0.4±0.8 times and from 4.9±3.6 times to 0.5±0.8 times respectively). In addition, the improvement in infant sleep was observed as soon as three days after the intervention.

Kerr, Jowett and Smith (1996), also tested the effectiveness of a health education program that claims to prevent infant sleeping problems. They recruited infants aged 3

months along with their parents. Infants were randomly assigned to a control and an intervention group. The researcher visited the house of each participant in the intervention group once and they discussed settling methods. Bedtime routines were also discussed. Each parent received a health education booklet with additional information after the home visit. After the intervention, results showed that only 21% of the intervention infants had settling problems compared to 39% of the control infants. In addition, intervention infants woke up 2 times a week compared to control infants who woke up 4 times a week.

In a different study Keefe, Lobo, Froese-Fretz, Kotzer, Barbosa and Dudley (2006) examined the effectiveness of a behavioral intervention to manage infant crying. They recruited infants aged 2-6 weeks of age along with their parents. Parents participated in group or individual sessions and followed the Rest Routine program. This program aims to reduce infant's arousal levels by altering behavioral and environmental factors. The basic goals of the program were to synchronize the parent-infant interaction, to reduce the magnitude and the length of infant fussiness, to promote a sense of schedule for the infant and to educate and advice parents. In addition, parents were instructed to track infant's sleeping behavior using sleep diaries. Both the infant and the parent were targeted by the intervention. Results showed that infant irritability was reduced. Infants in the intervention group cried 1.7 hours less per day than the control infants.

St James-Roberts, Sleep, Morris, Owen and Gillham (2001) tested the effectiveness of a behavioral program to prevent infant sleeping and crying problems. They recruited newborns and their parents and randomly assigned them to three groups. The behavioral group received a leaflet describing the intervention. The main topics were the importance of differentiating daytime and nighttime and to promote organized sleep routines for the infant. The education group received a 10-page booklet with information about infant sleeping and crying. It did not describe a structured program, but it offered advice that parents could follow depending on the individual needs of their infants. Finally, the control group received the regular information provided by the health authorities after childbirth. The results showed that 10% more infants in the behavioral group had 5 hours or more of uninterrupted night sleep compared to the infants in the education and control group.

Hiscock, Cook, Bayer, Psych, Mensah, Cann, Symon and St James-Roberts (2014), conducted a randomized controlled trial to assess whether a behavioral intervention could prevent infant sleeping and crying problems. They recruited newborns and their parents and randomly assigned them to an intervention and a control group. The intervention group received a booklet and a DVD when infants were 4 weeks old. The booklet and the DVD

contained similar information about infant sleeping and crying patterns, settling techniques, medical causes of crying and parent self-care. When infants were 8 weeks old parents were provided with phone sessions and when infants were 13 weeks old parents participated in group sessions where similar topics were discussed. The control group received the regular care provided after childbirth. The results showed that there were no statistically significant differences between the two groups. However, the authors concluded that the intervention can be proven efficient for infants who are fed frequently, because they sleep less during the day due to the frequent feedings and they cry less compared to infants who are not fed that frequently.

Hall, Hutton, Brant, Collet, Gregg, Saunders, Ipsiroglu, Gafni, Triolet, Tse, Bhagat and Wooldridge (2015) conducted a randomized controlled trial to evaluate the effectiveness of a behavioral intervention on infant sleeping problems. They recruited infants aged 6-8 months old along with their parents. Infants and parents were randomly assigned to an intervention and a control group. Parents in the intervention group were trained on how to use the controlled crying strategy. Also, they were given videos showing how to use this strategy and printed Power Points with the information presented at the training sessions, Finally parents were instructed to track infant's sleep using sleep diaries and charts. Parents in the control group received the safety regulations for infants given after childbirth. Results showed that infants in the intervention group woke up fewer nights per week and the duration of sleep increased.

Hiscock and Wake (2002) assessed the effectiveness of an intervention on infant sleeping problems. They recruited infants 6-12 months old and their parents. Participants were randomly assigned to an intervention and a control group. Parents in the intervention group received three individual sessions with information on how to use the controlled crying strategy. The control group received a leaflet with information about infant sleeping and crying behavior. Results of the intervention showed that sleeping problems were reduced in the first two months after the intervention but not at the 4-month follow up.

Symon, Marley, Martin and Norman (2005) were also interested in assessing the effects of a behavioral intervention on infant sleep. As in previous studies, they recruited infants and their parents and randomly assigned them to an intervention and a control group. Parents in the intervention group received a 45-minute session with a nurse during which infant sleep behavior was discussed. Parents also received a hard copy with all the topics covered in the sessions. Parents in the control group received the regular health-care provided

after childbirth. Results showed that duration of infant night sleep had improved for the infants in the intervention group.

Stremler, Hodnett, Lee, MacMillan, Mill, Ongcangco and Willan (2006) conducted a study to assess the effectiveness of a behavioral intervention on infant sleep. They recruited infants and their parents and they randomly assigned them to an intervention and a control group. Each parent in the intervention group participated in a 45-minute individual session with a nurse where they were informed about infant sleep and ways to promote healthy sleep patterns. Parents were also given a booklet with the information covered in the session. Parents in the control group participated in a 10-minute meeting where basic information about infant sleep cycles were given. In addition, they received a 1-page leaflet with the same information and phone calls in week 3 and week 5 of the program. Results showed that the intervention was effective. Infants in the intervention group slept for more hours during the night and woke up fewer times.

Adair, Zuckerman, Bauchner, Philipp and Levenson (1992) assessed the effects of an intervention on infant night awakenings. They recruited infants 4-9 months old along with their parents and randomly assigned them to an intervention group and a control group. Parents in the control group received the regular instructions about infant care. The intervention was divided in two phases. In the first phase, parents received two 1-page leaflets containing information about infant sleeping and feeding. Advice in relation to infant sleep was to put the infant to bed while still awake in order to gradually learn to go to sleep without the presence of the parent. In the second phase parents were instructed to use charts to keep track of their infant's sleeping and feeding periods. Results showed that the intervention led to a 36% reduction of the times infants woke up during the night.

Field, Gonzaleza, Diegoa and Mindellc (2016) tested the effectiveness of massages with lavender oil on infant sleeping problems. They recruited newborns and their parents. Participants were randomly assigned to three groups. Mothers of the first group (intervention group) gave massages with lavender lotion to the infants for 15 minutes per day for a month. Mothers of the second group gave massages to their infants for the same duration and time period as the first group, but without the lavender lotion. The third group (control group) did not give massages at all. Results of the study showed that infants' sleep in the intervention group improved. The times of night awakenings decreased, the sleep duration increased and it was easier for these infants to fall asleep.

Field, Field, Cullen, Largie, Diego, Schanberg and Kuhn (2008) also tested the effectiveness of lavender oil but in the form of a bath oil. They recruited young infants and

their parents. Participants were randomly assigned to three groups. Mothers of the first group bathed their infants with lavender oil. Mothers of the second group bathed their infants with a non-aroma bath oil. Mothers of the third group bathed their infants with lavender oil and in addition they watched an advertisement of the beneficial effect of lavender oil on infants. Emphasis was put on the fact that it reduces stress and thus it is easier for infants to sleep. The researchers measured and took into account the cortisol levels of infants as well. Results showed that infants in the lavender oil bath condition with no advertisement cried less after the bath, were less stressed and fell asleep easier compared to the infants in the other two conditions.

Çetinkaya and Başbakkal (2012) were also interested in the effectiveness of lavender oil on infant crying. They recruited infants 2-6 weeks old and their parents. Participants were randomly assigned to an intervention and a control group. Mothers of the intervention group massaged their infants with lavender oil for 5 to 15 minutes a day. In addition they tracked their infant's crying periods. Infants in the control group did not receive a massage at all. The results showed that the average time infants cried per week decreased compared to infants in the control group.

Spencer, Moran, Lee and Talbert (1990) assessed the effectiveness of white noise on infant sleep. Infants participating in the study were randomly assigned to an intervention and a control group. The researchers used the sound of a vacuum cleaner and the noise inside a car travelling at 50 km/h. Infants in the intervention group were exposed to the sounds when put in the crib. Then, they were monitored to observe whether the infants were asleep after being exposed to the white noise. Results showed that 80% of the infants in the intervention group fell asleep after being exposed to the white noise. These infants fell asleep only 2 minutes after being exposed to the white noise. However, the intervention was effective only for infants that were well fed.

Forquer and Johnson (2005) also examined the effectiveness of white noise on infant sleep. They recruited four families and used the sound of a fan or a humidifier. Parents were also instructed to keep track of their infant's sleep using sleep diaries. Results showed that sleep behavior was improved for 3 of the 4 infants who participated in this study. Night awakenings and refusal to go to sleep were reduced.

The advice mentioned in the interventions presented above, will form the base of our evaluation of the parenting websites and applications. Because we are interested in examining the trustworthiness of health advice about sleeping and crying problems in infants, it is crucial to form an evaluation that is based on evidence-based advice. In addition, many

people who search for health-related information online tend to trust all or the majority of the information they find online. According to a study that was conducted in the United States, 72% of the people who were seeking online information about a health issue believed that the information they obtained from online sources was trustworthy (Fox & Rainie, 2002). This can be extremely dangerous for infants whose parents blindly trust all the information they obtain online about infant sleeping and crying problems. What is more, in a study conducted by Scullard, Peacock and Davies (2010) it was found that only 39% of the 500 websites they evaluated presented accurate health-related information about children. In the case of health-related information for infants, this percentage is quite low due to the sensitivity of infants and the potential damage that can be caused to them if their parents follow an inaccurate advice found online. Thus, we chose to base our evaluation on the advice presented earlier, because this has been proven to be effective in multiple interventions.

The present study

In the present study, we will evaluate the most popular parenting websites and applications that aim at parents of infants up to 1 year of age, based on their content and whether there were experts (e.g. health-care professionals) involved in the making of the content. The reason for targeting infants up to 1 year of age is that after the first year the majority of infants stop waking up during the night or learn to self-sooth. Moore and Ucko (1957), examined sleeping disturbances during the period between 12pm to 5am and found that 90% of the infants that participated in the study stopped waking up during this period by the age of 9 months. Also, Anders and Keener (1985) reported in their study that uninterrupted sleep lasted approximately 7 hours for 1-year-old infants. We therefore expect the majority of problems to occur in the first year. Our content evaluation will be based on the strategies that were used in the interventions described earlier. Using these strategies we will create a form with topics related to infant sleeping and crying problems and we will assess if and how many of these topics are addressed in the parenting websites and applications we will evaluate.

The topics that we will include in our evaluation form are coming from the interventions described earlier and from advice from St James-Roberts (n.d.). The topics we created from the interventions are the following. First, since the majority of the interventions were using leaflets, books, websites or group/individual sessions to inform parents about infant sleeping and crying problems, we will examine whether there is a section in the

parenting websites and applications that presents this kind of information. Next, some interventions used the controlled crying strategy (or graduated extinction) to teach parents how to put their infants to sleep. According to the controlled crying strategy parents should not respond immediately to their infant's crying or night waking. Instead, starting from 2 minutes their response time is gradually increased until the infant stops waking up during the night or until the length of night sleep has increased to a desired duration. The aim of this strategy is to teach infants how to self-sooth and gradually learn to fall back to sleep on their own (Korownyk & Lindblad, 2018). Other interventions advised parents to differentiate day and night and to put the infant to sleep while still awake in order to learn to self-soothe and fall asleep in the crib. Thus, these topics were also included in our evaluation. A few interventions mentioned the importance of setting bedtime routines to give the infant a sense of a routine and teach them that they are preparing to go to sleep. In addition, some interventions proposed bath and massages (with or without lavender oil) or the use of white noise as part of the bedtime routines. For this reason bedtime routines were also included in our evaluation. Finally, interventions suggested tracking infant's sleep in order to assess whether infant's sleep is indeed problematic and thus tracking infant's sleep was also included in our evaluation.

The topics we created for our evaluation using the advice of St James-Roberts (n.d.) are the following: 1) in the first weeks after birth use lots of carrying and close physical contact between parents and infants to minimize crying at this age, 2) to make an infant relax place it in a crib or similar place and avoid feeding or cuddling it to sleep, 3) reduce light and social interaction at night and 4) after 6 weeks of age delay feeding for a while when infants wake up at night. In addition, it was mentioned that bed sharing is not recommended and if used infants should be put to sleep on their backs. However, continuation of bed-sharing after the first few weeks may lead the infant to continue waking up at night and signaling its parents. Thus, bed sharing was included as a topic in our evaluation. Finally, positive behavior methods were mentioned as an effective sleep training method. According to this method parents create a safe environment (using bedtime routines for example) and in this way they help their infants to go to sleep.

Finally two sleep training strategies were added as topics of our evaluation. These strategies are the cry it out strategy and the extinction with parental presence or camping out strategy. According to the cry it out method, parents should leave their infants to cry without getting involved until the infant learns to self soothe and fall back to sleep (Kuhna & Elliott, 2003). According to the camping out strategy, parents place a chair next to the infant's crib

and wait until the infant falls asleep. After 2 nights parents move the chair a few meters away from the crib and again wait until the infant falls asleep. This process is repeated until the infant learns to sleep without the parent being present in the room (Kuhna & Elliott, 2003). The reason for adding these strategies in our evaluation, is that although they were not only targeting infants up to 1 year of age, they were found to be effective for infants between 9-12 months in different studies (Kuhna & Elliott, 2003; Mindell, Kuhn, Lewin, Meltzer, & Sadeh, 2006; Sadeh, 1994).

Method

Phase 1: Website and Application selection

Website selection. Websites about preventing and treating infant sleeping and crying problems were obtained using Google Chrome browser and Google and Bing search engines. These search engines were selected because they were the most popular search engines used worldwide as measured until October 2018 (Worldwide desktop market share of leading search engines from January 2010 to October 2018, 2018). The keywords that were used were infant sleep problems, infant sleep cycles, infant crying patterns, infant bed sharing, infant crying cycles, infant bedtime routines, sleep training strategies, tracking infant sleep and bedtime routines. These keywords were selected because we believe that they were the most accurate descriptions to help us locate parenting websites with information about infant sleeping and crying problems. For each keyword the websites of the first page of the results of each search engine were scanned. The reason for searching only in the first page of the results is that users rarely visit websites listed after the first page of the results. Eysenbach and Köhler (2002), conducted a study where they observed how consumers use the search engines to obtain information. Of the 21 participants only nine participants looked at the results of the second page of their search and only five clicked on a result that was listed on the second page or a following page. In fact, in 97.2% of the cases participants visited a website that was listed among the 10 first results of the search engine and in 71.3% of the cases participants visited a website that was listed among the first 5 results (Eysenbach and Köhler, 2002).

Inclusion criteria were that (1) the language of the websites was English, (2) the targeted audience consisted of parents of infants up to 1 year of age, (3) there was a separate section about infant sleep or infant crying, (4) the main scope of the website was about

parenting of infants, (5) topic was about preventing and treating infant sleeping and crying problems, sleep patterns, crying patterns, bed sharing, bedtime routines, tracking of infant sleep or sleep training strategies. Websites that were about infant care but did not include any information about infant sleeping or infant crying problems were excluded.

Application selection. Applications about preventing and treating infant sleeping and crying problems were obtained using the Play store (Android) and the App store (iOS). The keywords used were the same as in the search for parenting websites listed earlier. Inclusion criteria for the applications from the Play store were the following: (1) the language of the application was English, (2) at least 40.000 users had downloaded the application, (3) user's rating was 4 stars or higher, (4) application was rated by at least 10.000 users, (5) the targeted audience was parents of infants up to 1 year of age, (6) the topic was about preventing and treating infant sleeping and crying problems, sleep patterns, crying patterns, bed sharing, bedtime routines or tracking of infant sleep (7) the last update was in January 2017 or later. Criterion 2 was set as a result of a research conducted by Koekkoek (2013). According to the results of this survey, applications that reach top 50 rank in the App Store need at least 25.000 downloads per day, applications that want to reach top 25 rank need at least 40.000 downloads and applications that want to reach top 10 rank need at least 73.000 downloads. With these results in mind and given the fact that in the present study we were interested in evaluating the most popular parenting applications, we decided to set a minimum of 40.000 downloads for each application to be included in the study. Using the same rationale, criterion 4 was set based on criterion 2. This means that we only included applications for which at least 1 out of the 4 users who downloaded them gave a rating. The rating we used is the rating provided by the Play store. The rating an application gets is the average of all the ratings users have given for this specific application. This rating must be 4 stars or higher (criterion 3). Thus, to include an application in our study, the overall rating of the application had to be 4 stars or higher. Applications from the Play store (Android) were obtained and downloaded on Xiaomi Redmi Note 5 Smartphone.

Because it was not possible to see the number of downloads on the App store the inclusion criteria for the applications from the App store were slightly different. Thus, we included applications that met the following criteria: (1) the language of the application was English, (2) rating was 4 stars or higher, (3) the targeted audience was parents of infants up to 1 year of age, (4) the topic was about preventing and treating infant sleeping and crying problems, sleep patterns, crying patterns, bed sharing, bedtime routines or tracking of infant

sleep and (5) the last update was in January 2017 or later. During the selection of the applications from the App store we did not use criterion 2 (at least 40.000 users had downloaded the application) and criterion 4 (application was rated by at least 10.000 users) that were used in the selection of the applications from the Play store. There are a few reasons for this choice. First, as mentioned earlier it was not possible to see the number of downloads an application had. Also, for all the applications we obtained through our search, the number of ratings was not more than 1000. Finally, criterion 4 was set according to criterion 2, thus since criterion 2 was excluded from the search of applications on the App store it made sense to exclude criterion 4 as well. Applications from the App store (iOS) were obtained and downloaded on iPad mini 3 tablet.

The exclusion criteria were the same for all the applications (both from the Play store and the App store). Applications that were about infant care but did not include any information about preventing or treating infant sleeping or crying problems were excluded. Applications that were not free were also excluded from the present study. This decision was made due to the fact that the majority of application consumers prefer free applications (even ones that include advertisements) over paid ones (Gordon, 2013). In addition, the majority of the existing applications in Play store and App store are free. In fact, up to the first quarter of 2018, 94% of the available applications in Play store were free and only 6% were paid, while 88% of the available applications in App Store were free and 12% were paid (Distribution of free and paid apps in the Apple App Store and Google Play as of 1st quarter 2018, 2018).

Phase 2: Website and Application Evaluation

Website evaluation. The evaluation of the parenting websites consisted of two criteria. The first criterion assessed the content of each website and whether the recommendations and the solutions provided were evidence-based. For this reason, an evaluation form was created with different topics of managing infant sleeping and crying problems. This method had been used in a previous study (Taki et al., 2015). The evaluation form consisted of 11 topics. The topics 2, 3, 5, 6 and 8 were discussed by St James-Roberts (n.d.) and adjusted for the purpose of the present study. The topics 1, 4, 7, 9, 10 and 11 were formulated by the strategies used in the effective interventions presented earlier and adjusted for the purpose of the present study. Appendix A summarizes all the topics used for the evaluation. Each website could score a maximum of 22 points. Appendix A presents the scoring system in detail. For each website we calculated a total score. The total score was

then converted into a percent grade. To interpret the total score of each application we used the classification used in the Health-Related Website Evaluation Form (HRWEF) (Pealer & Dorman, 1997). This classification had been used in a previous study where a similar evaluation form had been created for a similar purpose (Taki et. al, 2015). Websites that scored 90% or higher were perceived as having excellent content, 89-75% adequate content and less than 75% poor content.

The second criterion assessed whether information about the author of each article and the ownership of the website could be obtained. For this assessment seven criteria used in previous studies were used (Bohacek, Gome and Fish, 2003; Martins and Morse, 2005). These criteria were (1) ownership, (2) purpose, (3) authorship, (4) author qualification, (5) attribution, (6) interactivity and (7) currency. Appendix A summarizes these criteria. The technical criteria used in previous studies were not used as they were out of the scope of this study. The scoring criteria used were the same as in the previous studies. The scoring criteria can be found in Appendix A. Each website could score a maximum of 12 points. For each website a total score was calculated based on the points obtained for each one of the seven criteria. Then, the total score of each website was converted into a percent grade. Websites that scored 80% or higher were perceived as having excellent authorship, 79-70% good authorship, 69-60% fair authorship and 59% or lower poor authorship.

Application evaluation. The evaluation of the parenting applications (both from the Play store and App store) consisted of the two criteria used previously for the evaluation of the parenting websites. To assess the content of each application and whether the recommendations and the solutions provided were evidence-based we used the same evaluation form as in the evidence-based evaluation of the websites. In addition, we used the same procedure, criteria and scoring system.

To assess the expert contribution an evaluation form (Appendix A) was created consisting of Silberg's standards (Silberg, Lundberg & Musacchio, 1997). Silberg's standards have been used in a similar study for a similar purpose (Zhao et al. 2017). These standards consist of nine criteria; (1) authors credited, (2) author's affiliations, (3) author's credentials, (4) information sources, (5) references given, (6) application ownership disclosed, (7) sponsorship disclosed, (8) application modified in the previous month and (9) creation of last modification date specified. Each application could score a maximum of 9 points. Appendix A summarizes the scoring criteria. Then, a total score was calculated for each application. The scores were then converted into a percent grade. To interpret the results we used the

same classification as in the expert contribution evaluation of the websites. Applications that scored 80% or higher were perceived as having excellent expert contribution, 79-70% good expert contribution, 69-60% fair expert contribution and 59% or lower poor expert contribution

Results

Phase 1: Website and Application selection

Website selection. The initial search in Google and Bing search engines lead to 220 websites. After removing duplicate websites, the number of the websites that were screened were 96. Based on the inclusion criteria 24 websites were evaluated. Table 1 summarizes the name, the purpose, the topic, the targeted audience and whether there was a separate section about infant sleep for each website that was evaluated. Fourteen (58.3%) of the websites were about preventing and treating sleeping problems and crying problems in infants and 10 (41.7%) were about preventing and treating infant sleeping problems. Three (7.2%) of the websites were specifically about preventing and treating infant sleeping and crying problems, whereas the rest of the websites (92.8%) included information about preventing and treating sleep problems for toddlers and young children. However, all the websites had a separate section about infant sleep.

Table 1

Description of websites

Name	URL	Purpose	Topics discussed	Targeted Audience	Separate section about infant sleep
Parenting Science	https://www.parentingscience.com/	Provide parents with evidence based information about parenting	Infant sleeping and crying problems	Parents of infants and young children	Yes
Parents	https://www.parents.com/	Provide parents of infants and young children with information about parenting	Infant sleeping and crying problems	Parents of infants and young children	Yes
The baby sleep site	https://www.babysleepsite.com/	Provide parents of infants up to 1 year of age with information about infant sleep, consultation, phone sessions, free ebooks	Infant sleeping problems	Parents of infants up to 1 year of age	Not applicable

Raising children: The Australian parenting website	http://raisingchildren.net.au/	Provide parents of infants up to teenagers with information about parenting	Infant sleeping and crying problems	Parents of newborns, infants, young children and teenagers	Yes
The period of purple crying	http://purplecrying.info/	Provide parents of infants with information about infant sleep and crying	Infant crying problems and a few information about infant sleeping problems	Parents of infants	Not applicable
Ask DRSears: The trusted resource for parents	https://www.askdrsears.com/	Provide parents of infants with information about infant sleep and crying	Infant sleeping and crying problems	Parents of infants	Yes
Baby center	https://www.babycenter.com/	Provide parents of infants and young children with information about infant sleep and crying	Infant sleeping and crying problems	Parents of infants and young children	Yes
Little ones	https://www.littleones.co/	Provide parents of infants and young children with information about infant sleep → but to get most of the information you have to buy the sleep programs	Infant sleeping problems	Parents of infants and young children	Not applicable
Baby sleep science	https://www.babysleepscience.com/	Provide parents of infants and young children with information about infant sleep → but to get most of the information you have to buy the sleep programs	Infant sleeping problems	Parents of infants and young children	Not applicable
Oh baby! Magazine	https://www.ohbabymagazine.com/newborn/	Provide parents of infants and young children with information about infant sleep and crying	Infant sleeping and crying problems	Parents of infants and young children	Yes
Zero to three: Early connections last a lifetime	https://www.zerotothree.org	Provide parents of infants and young children up to three years old with information about infant sleep	Infant sleeping problems	Parents of infants and children up to three years old	Yes
Today's Parent	https://www.todaysparent.com/	Provide parents of infants and young children up to three years old with information about infant sleep and crying	Infant sleeping and crying problems	Parents of infants and young children	Yes

What to expect	https://www.whattoexpect.com/	Provide parents of infants and young children with information about infant sleep and crying	Infant sleeping and crying problems	Parents of infants and young children	Yes
My baby sleep guide	http://www.mybabysleepguide.com/	Provide parents with information about infant sleep and crying	Infant sleeping and crying problems	Parents of infants and young children	Not applicable
Kidspot. A million of mums. One spot.	https://www.kidspot.com.au/	Provide parents of infants and young children with information about infant sleep	Infant sleeping problems	Parents of infants and young children	Yes
Sleep baby love. Child sleep consultant	https://www.sleepbabylove.com/	Sleep consulting - Provide parents of infants and young children with information about infant sleep	Infant sleeping problems	Parents of infants and young children	Not applicable
The bump	https://www.thebump.com/	Provide parents of infants and young children with information about infant sleep	Infant sleeping problems	Parents of infants and young children	Yes
Rookie Moms	https://www.rookiemoms.com/	Provide parents of infants and toddlers with information about infant and toddler development and sleep	Infant sleeping problems	Parents of infants and toddlers	Not applicable
Parenting Healthy Babies	https://parentinghealthybabies.com/	Provide parents of infants and toddlers with advice on parenting	Infant sleeping and crying problems	Parents of infants and toddlers	Yes
Mother and Baby	https://www.motherandbaby.co.uk/	Provide parents of infants and toddlers with information about infant care	Infant sleeping and crying problems	Parents of infants and toddlers	Yes
Healthy Children. Powered by pediatricians. Trusted by parents.	https://www.healthychildren.org	Provide information about parenting of infants up to teenagers	Infant sleeping and crying problems	Parents of infants up to teenagers	Yes
Verywell family	https://www.verywellfamily.com/	Provide information about parenting of infants, toddlers and young children	Infant sleeping and crying problems	Parents of infants, toddlers and young children	Yes
Belly Belly	https://www.bellybelly.com.au/	Provide information about infant care and parenting of toddlers and young children	Infant sleeping problems	Parents of infants, toddlers and young children	Yes
Precious little sleep	https://www.preciouslittlesleep.com/	Provide parents with information about sleep for infants, toddlers and young children	Infant sleeping problems	Parents of infants, toddlers and young children	Not applicable

Application selection.

Play store. The initial search in Play Store (Android) resulted in 2000 applications. After removing duplicate applications and following the inclusion criteria only 18 applications were eligible for this study. Applications that met some, but not all of the inclusion criteria were excluded from the study. From the 18 applications, three applications were excluded because they only contained abstract melodies that parents could use to put their infants to sleep. These application didn't include the sound of a washing machine, a speeding car, rain, hairdryer or humidifier that were found to be effective in interventions to prevent or treat infant sleeping and/or crying problems (see literature review of effective interventions to treat or prevent infant sleeping and/or crying problems section in introduction). In contrast, these applications only included songs for children or abstract melodies. Thus, 15 applications were included in the study. The minimum number of downloads of the applications that were included in the study was 100.000 and the maximum was 10.000.000. Similarly, the minimum number of stars obtained was 4.4 and the maximum was 4.9. The minimum number of ratings was 10.809 and the maximum was 745.510. The oldest date of the original publication was October 1, 2008 and the newest was July 18, 2017. All the applications had been updated in 2018 except for one that had been last updated on December 2, 2017. All the applications were free, but eight (53.3%) of them had in-app purchases. Seven (46.7%) applications were infant sleep tracking applications, six (40%) provided parents with different types of white noise and two (13.3%) provided general information about infant sleep and crying problems. Table 2 summarizes in detail each application included in the study.

Table 2

Description of applications (Play store)

Name of the application	Publisher	Number of downloads	Stars	Number of ratings	Date of publishing	Date of last update	Topic	Language	Cost

Baby Daybook - Tracking of breastfeeding and care	Drilly Apps	500.000	4.7	31.239	04/05/14	10/11/18	Sleep tracking app	English	Free - in app purchases
Baby Care	Breet.Jia	1.000.000	4.4	17.222	05/12/10	02/12/17	Sleep tracking app	English	Free
Baby Sleep: White noise lullabies for newborans	Urbandroid (Petr Nálevka)	1.000.000	4.6	63.608	13/08/13	04/10/18	White Noise	English	Free – in app update to PRO
Baby Manager - Baby Tracker & Breastfeeding track	Baby Mananger Ltd	100.000	4.8	13.618	28/09/15	13/06/18	Sleep tracking app	English	Free - in app purchases
Baby Sleep - White Noise	Relaxio	1.000.000	4.8	14.411	09/09/16	23/10/18	White noise	English	Free - in app purchases
BabyTime (Parenting, Track & Analysis)	Simfler	500.000	4.7	11.572	19/11/10	20/10/18	Sleep tracking app	English	Free
Baby tracker - feeding, sleep and diaper	Amila	100.000	4.9	21.867	18/07/17	28/12/18	Sleep tracking app	English	Free
Pregnancy Tracker & Countdown to Baby due date	BabyCenter	10.000.000	4.7	745.510	11/03/11	04/12/18	Information about infant sleeping and crying problems	English	Free

Baby Tracker - Newborn Feeding, Diaper, Sleep log	NIGHP SOFTWARE	500.000	4.6	15.680	09/07/15	11/03/18	Sleep tracking app	English	Free - in app purchases
Night Light for Baby. Instant Sleep. White Noise	Bipfun - Best Apps for babies	1.000.000	4.4	33.702	16/01/15	14/06/18	White noise	English	Free - in app purchases
White Noise Lite	TMSOFT	1.000.000	4.4	58.937	01/10/08	14/12/18	White noise	English	Free
Feed Baby - Baby Tracker	Penguin Apps	1.000.000	4.5	78.724	11/10/11	01/08/18	Sleep tracking app	English	Free - in app purchases
White Noise Baby Sleep Sounds	AMICOOLSOFT	1.000.000	4.8	27.740	17/12/15	24/09/18	White noise	English	Free
White Noise Baby	TMSOFT	1.000.000	4.5	10.809	17/04/13	14/12/18	White noise	English	Free - in app purchases
Indian Pregnancy & Parenting tips, The Babycare App	Healofy - Parenting Baby care & Pregnancy	1.000.000	4.7	24.757	21/04/16	15/09/18	Information about infant sleeping and crying problems	English	Free

App store. The initial search in App Store (iOS) resulted in 1800 applications. After removing duplicate applications and following the inclusion criteria only 18 applications were eligible for this study. Applications that met some, but not all of the inclusion criteria were excluded from the study. From the 18 applications, one application was excluded because it was merely a forum where parents can contact each other and talk about infant sleeping and crying problems, but there was no advice from a health-care professional and parents had to buy the PRO version to get actual advice. Thus, 17 applications were included

in the study. The minimum rating an application had received was 4 stars and the maximum was 5 stars. In relation to the topic of the applications six (35.3%) were tracking applications that included sleep tracking charts, nine (53%) provided parents with white noise and only two (11.7%) provided parents with general information and advice about infant sleeping and crying problems. The oldest update of an application was in June 2018 and the most recent was in February 2019. The language of all the applications was English. In relation to the cost, two (11.7%) applications were entirely free, while 15 (88.3%) were free but they had in-app purchases. This means that in order to access the entire content of the application or to unlock all the features users should buy the PRO version. Table 3 summarizes in detail each application included in the study.

Table 3

Description of applications (App Store)

Name	Publisher	Stars	Last update	Topic	Language	Cost
Sprout Baby	Med ART Studios	4.5	February 2019	Sleep tracking app	English	Free, in app purchases
Baby tracker	Nighp SoftwareLLC	4.5	December 2018	Sleep tracking app	English	Free, in app purchases
Awesome Baby tracker	Pavel Krivushenkov	4.9	October 2018	Sleep tracking app	English	Free in app purchases
Feed Baby - Breastfeeding App	Penguin Apps PTY LTD	4.6	July 2018	Sleep tracking app	English	Free, in app purchases
Baby tracker	Fitness Labs SRL	4.5	February 2019	Sleep tracking app	English	Free, in app purchases
Sound Sleeper: White Noise	Michael Feigenson	4.9	January 2019	White noise	English	Free, in app purchases
Sleeptot - baby white noise	Burleigh creative pty ltd	4.1	February 2019	White noise	English	Free in app purchases
Baby Sleep	Phsase4 mobile, inc.	4.6	December 2018	White noise	English	Free, in app purchases
Baby Sleep Sounds	Mehmet Kocabas	5	October 2018	White noise	English	Free, in app purchases
Baby sleep sounds - Guva plus	Ertan eksi	4.8	February 2019	White noise	English	Free in app purchases
Sleepy sounds	owenTech	4.3	June 2018	White noise	English	Free, in app purchases

BabyCenter	Baby Center	4.8	February 2019	General information and advice about infant sleeping and crying problems	English	Free
Baby+	Health & Parenting LTD.	4.7	October 2018	General information and advice about infant sleeping and crying problems	English	Free
Baby Tracker - Newborn Care	Zooba Quarks	4.0	October 2018	Sleep tracking app	English	Free in app purchases
Colic baby	Mehmet yazik	4.5	July 2018	White noise	English	Free in app purchases
Vacuum cleaner sounds for baby	Mehmet Kocabas	4.8	October 2018	White noise	English	Free in app purchases
White Noise Baby Lite	TMSOFT	4.7	November 2018	White noise	English	Free in app purchases

Phase 2: Website and Application Evaluation

Website evaluation. The first criterion assessed was related to the topics discussed in the websites in relation to infant sleeping and crying problems. The maximum score a website could obtain was 22. Data analysis showed that the mean score was 11.38 (*SD* = 3.28). The minimum score was 3 and the maximum score was 16 (Table 4).

Table 4

Descriptive statistics of the total score of websites (content evaluation)

Mean	Std. Deviation	Minimum	Maximum	N
11.38	3.28	3	16	24

One (4.2%) website scored 3, which was the lowest score obtained and three (12.5%) websites scored 16, which was the highest score obtained. Four (16.7%) websites scored 11, four (16.7%) 13 and three (12.5%) websites scored 10. The scores of the rest of the websites are presented in Table 5. Based on the percentage form of the total score of each website, our results suggest that the content of all the websites included in this study was poor. Table 5 summarizes the total score and the percentage form of the total score for all the websites based on their content.

Table 5

Total score of websites (content evaluation)

Total score	Total score in percentage	Frequency	Percent
3	13.6%	1	4.2%
6	27.3%	1	4.2%
8	36.4%	2	8.3%
9	40.9%	2	8.3%
10	45.5%	3	12.5%
11	50.0%	4	16.7%
12	54.6%	1	4.2%
13	59.1%	4	16.7%
14	63.6%	1	4.2%
15	68.2%	2	8.3%
16	72.7%	3	12.5%
Total		24	100.0%

We also investigated the topics related to infant sleeping and crying problems that were discussed on these websites. The most discussed topics were the explanation of infant sleep cycles and infant sleep development that were found in 22 (91.8%) and 23 (95.8%) websites respectively. In 17 (70.8%) websites bed sharing was not recommended, but 15 (62.5%) of these websites instructed parents to put their infants to sleep on their backs or sides if bed sharing is practiced. Twenty three (95.8%) websites talked about the importance of establishing bedtime routines for infants with 20 (83.3%) proposing the use of white noise.

Nineteen (79.2%) websites mentioned that light and social interaction should be reduced during the night. In relation to sleep training strategies, 16 (66.7%) talked about the controlled crying strategy. Only two (8.3%) websites talked about the importance of tracking infant's sleep, while only one (4.2%) provided a chart for tracking infant's sleep. Finally, 19 (79.2%) websites instructed parents to put their infants to sleep while they are still awake. Table 6 provides details about all the topics discussed in the websites.

Table 6

Frequency of the topics discussed in websites

Topic	Subtopic	Frequency	Percent
General information about sleep and crying patterns in infants	Infant sleep cycles explained	22	91.8%
	Infant sleep development explained	23	95.8%
	Infant crying cycles explained	8	33.3%
In the first weeks use lots of carrying and close physical contact between parents and infants to minimize crying at this age		4	16.7%
Bed sharing	Bed sharing is not recommended	17	70.8%
	If used infants should be put to sleep on their backs or sides	15	62.5%
	Continuation of bed sharing after the first few weeks may lead the infant to continue wake up and signal during the night	0	0.0%
Bedtime routines	Establish bedtime routines	23	95.8%
	Give a bath to your infant (using lavender oil is recommended)	18	75.0%
	Give a massage to your infant (using lavender oil is recommended)	15	62.5%

	Play a white noise but the keep the volume down	20	83.3%
To make the infant relax place it in a crib or similar place and avoid feeding or cuddling it to sleep		8	33.3%
Reduce the light and the social interaction at night		19	79.2%
Differentiate daytime and night time		9	37.5%
After six weeks of age delay feeding for a while when infants wake up at night		6	25.0%
Sleep training strategies	Controlled crying or graduated extinction	16	66.7%
	Cry it out	14	58.3%
	Positive behavior methods	5	20.8%
	Extinction with Parental Presence or Camping out (parents have minimum interaction)	9	37.5%
Tracking of infant's sleep	Explanation of importance	2	8.3%
	Provide charts and/or sleep diaries	1	4.2%
Put infant to crib while still awake		19	79.2%
Total		24	100.0%

The second criterion we assessed was whether an expert contributed in the making of the content of the websites. The maximum score a website could get was 12. Data analysis showed that the minimum score was 2 and the maximum score was 10. The mean score was 7.17 (*SD* = 1.93) (Table 7). For the criterion of ownership 23 (95.8%) websites clearly stated their ownership/ sponsorship. In addition, 12 (50%) websites stated that the main purpose of the website was to educate parents but there was also a financial gain for the website. Twenty (83.3%) websites provided all the information in relation to authorship, but in only four (45.8%) of them the author was a health-care professional. Five websites provided no

references for the information offered in them, but 10 (41.7%) provided a telephone number, email, or mailing address. Twelve (50%) websites had a clear invitation to comment or ask questions by using an email address or a link to a form. Table 8 summarizes the scores of the websites in each category.

Table 7

Descriptive statistics of the total score of websites (expert contribution evaluation)

Mean	Std. Deviation	Minimum	Maximum	N
7.17	1.93	2	10	18

Table 8

Scores of websites on each criterion (expert contribution evaluation)

	0		1		2	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Ownership	1	4.2%	23	95.8%	N/A	
Purpose	1	4.2%	12	50%	11	45.8%
Authorship	4	16.7%	20	83.3%	N/A	
Author qualification	9	37.5%	11	45.8%	4	16.7%
Attribution	5	20.8	11	45.8%	8	33.3%
Interactivity	2	8.3%	10	41.7%	12	50%
Currency	10	41.7%	13	54.2%	1	4.2%
Total	24		24		24	

In relation to the total score of each website, one (4.2%) website scored 2, which was the minimum score obtained, and four (16.7%) websites scored 10, which was the maximum score obtained. Eight (33.3%) websites scored 7, while four (16.7%) scored 6 and four (16.7%) scored 8. Our results showed that 15 websites had poor expert contribution, four had fair expert contribution, one had good expert contribution and four had excellent expert contribution (see Appendix B for more details). Table 9 summarizes the total score and the percentage form of the total score obtained by each website included in this study based on the expert contribution in the making of the content.

Table 9

Total score of websites (expert contribution evaluation)

Total score	Total score in percentage	Frequency	Percent
2	16.7%	1	4.2%
4	33.3%	1	4.2%
5	41.7%	1	4.2%
6	50.0%	4	16.7%
7	58.3%	8	33.3%
8	66.7%	4	16.7%
9	75.0%	1	4.2%
10	83.3%	4	16.7%
Total		24	100.0%

Application Evaluation.

Play store. The first criterion of our evaluation was the topics related to infant sleeping and crying problems that were discussed in these applications. The maximum score an application could get for the content was 22. Data analysis showed that the mean score

was 2.33 (*SD* = 3.24) and the minimum score was 0. No application scored higher than 13 points (Table 10). In fact, one (6.7%) application scored 0, eight (53.3%) scored 1, four (26.7%) scored 2, one (6.7%) scored 6 and only one (6.7%) scored 13. Based on the percentage form of the total score of each application, the content of all the applications was poor (see Appendix for more details). Table 11 summarizes the total score for each application along with the percentage form of each total score.

Table 10

Descriptive statistics of the total score of applications from Play Store (content evaluation)

Mean	Std. Deviation	Minimum	Maximum	N
2.33	3.24	0	13	15

Table 11

Total score of applications from Play store (content evaluation)

Total score	Total score in percentage	Frequency	Percent
0	0.0%	1	6.7%
1	4.55%	8	53.3%
2	9.1%	4	26.7%
6	27.27%	1	6.7%
13	59.1%	1	6.7%
Total		15	100.0%

We also wanted to know which topics were actually discussed in these applications. Our results showed that one (6.7%) application explained infant's sleep cycles, one (6.7%) application explained infant sleep development and one (6.7%) application explained infant

crying cycles. Bed sharing was not recommended in one (6.7) application, while two (13.3%) proposed that infants should be put to sleep on their backs or sides when bed sharing is practiced. In relation to bedtime routines, 10 (66.7%) proposed the use of white noise, but only two (13.3%) explained the importance of establishing bedtime routines. In addition, two (13.3%) applications proposed giving a bath to infants as part of a bedtime routine, while one (6.7%) proposed giving a massage. Sleep training strategies was the least discussed topic. One (6.7%) application provided information about the controlled crying strategy, one (6.7%) application provided information about the cry it out strategy and one (6.7%) application provided information about the camping out strategy. Finally, eight (53.3%) applications provided a chart for tracking infant's sleep but only two (13.3%) explained the importance of this practice. None of the applications mentioned using carrying and close physical contact between parents and infants in the first weeks to minimize crying at this age, differentiate daytime and night time, delay feeding for a while when infants wake up at night after six weeks of age or putting infant to crib while still awake. Table 12 summarizes these results in detail.

Table 12

Frequency of the topics discussed in applications from Play store (content evaluation)

Topic	Subtopic	Frequency	Percent
General information about sleep and crying patterns in infants	Infant sleep cycles explained	1	6.7%
	Infant sleep development explained	1	6.7%
	Infant crying cycles explained	1	6.7%
In the first weeks use lots of carrying and close physical contact between parents and infants to minimize crying at this age		0	0.0%
Bed sharing	Bed sharing is not recommended	1	6.7%
	If used infants should be put to sleep on their backs or sides	2	13.3%

	Continuation of bed sharing after the first few weeks may lead the infant to continue wake up and signal during the night	0	0.0%
Bedtime routines	Importance of establishing bedtime routines	2	13.3%
	Give a bath to your infant (with or without lavender oil)	2	13.3%
	Give a massage to your infant (with or without lavender oil)	1	6.7%
	Play a white noise but keep the volume down	10	66.7%
To make an infant relax place it in a crib or similar place and avoid feeding or cuddling it to sleep		0	0.0%
Reduce the light and the social interaction at night		1	6.7%
Differentiate daytime and night time		0	0.0%
After six weeks of age delay feeding for a while when infants wake up at night		0	0.0%
Sleep training strategies	Controlled crying or graduated extinction	1	6.7%
	Cry it out	1	6.7%
	Positive behavior methods	0	0.0%
	Extinction with Parental Presence or Camping out (parents have minimum interaction)	1	6.7%
Tracking of infant's sleep	Explanation of importance	2	13.3%
	Provide charts and/or sleep diaries	8	53.3%
Put infant to crib while still awake		0	0.0%
Total		15	100.0%

The second criterion we assessed was whether an expert had contributed in the making of the content of these applications. The maximum an application could score was 9. Data analysis showed that the minimum score acquired was 2 while the maximum score was 9. The mean score was 2.93 (*SD* = 1.75). Table 13 summarizes these results.

Table 13

Descriptive statistics of the total score of applications from Play store (expert contribution evaluation)

Mean	Std. Deviation	Minimum	Maximum	N
2.93	1.75	2	9	15

In contrast with the evaluation of the content, no application scored below 2. In fact, seven (46.7%) applications scored 2, seven (46.7%) scored 3 and one (6.7%) scored 9 (Table 14). Based on our data and the percentage form of the total scores, 14 (93.4%) applications had poor expert contribution and only one (6.7%) had excellent expert contribution (see Appendix B for more details). The percentage form of the total score of each website can be found in Table 14. All the applications had information about the ownership of the application and the last modification date. However, only eight (53.3%) applications had been modified or updated during the last month. In addition, only one (6.7%) application listed the authors of the information provided in the application, the author's affiliations, the author's credentials, references for the provided information and details about the sponsorship of the application. Table 15 summarizes these results.

Table 14

Total score of applications from Play store (expert contribution evaluation)

Total score	Total score in percentage	Frequency	Percent
2	22.22%	7	46.7%
3	33.33%	7	46.7%

9	100.0%	1	6.7%
Total		15	100.0%

Table 15

Scores of applications from Play store on each criterion (expert contribution evaluation)

Criterion	Frequency	Percent
Authors credited	1	6.7%
Author's affiliations	1	6.7%
Author's credentials	1	6.7%
Information sources	1	6.7%
References given	1	6.7%
App ownership disclosed	15	100.0%
Sponsorship disclosed	1	6.7%
App modified in the previous month	8	53.3%
Creation of last modification date specified	15	100.0%

App store. The first criterion of our evaluation was to evaluate the topics that were discussed in parenting applications in relation to infant sleeping and crying problems. For this reason we evaluated the content of these applications. The maximum score that an application could get for its content was 22. Data analysis showed that the mean score of the applications we evaluated was 3.29 (*SD* = 3.95). The minimum score was 1 and the maximum score was 13 (Table 16).

Table 16

Descriptive statistics of the total score of applications from App Store (content evaluation)

Mean	Std. Deviation	Minimum	Maximum	N
3.29	3.95	1	13	17

In more detail, 11 (64.7%) of the 17 applications we evaluated scored 1. Each one of the remaining six applications scored 2, 4, 7, 8, 11 and 13. In contrast with the applications we evaluated from the Play store (Android) no application scored 0. However, similarly to the applications from the Play store no application scored higher than 13. Based on the percentage form of the total score of each application, the content of all the applications was poor. Table 17 presents these results.

Table 17

Total score of applications from App store (content evaluation)

Total score	Total score in percentage	Frequency	Percent
1	4.55%	11	64.7%
2	9.1%	1	5.9%
4	18.19%	1	5.9%
7	31.82%	1	5.9%
8	36.36%	1	5.9%
11	50%	1	5.9%
13	59.1%	1	5.9%
Total		17	100.0%

In addition to this, we also wanted to know what were the topics that were actually discussed in these applications. Our data showed that four (23.5%) applications explained infant's sleep cycles, four (23.5%) explained infant's sleep development and two (11.8%) explained infant's crying cycles. Two (11.8%) applications suggested that in the first weeks parents should use lots of carrying and close physical contact with the infant to minimize crying. Bed sharing was a subject that was almost not discussed at all, with only one (5.9%) application stating that bed sharing is not recommended and two (11.8%) applications advising that if used infants should be put to sleep on their backs or sides. Four (23.5%) applications explained the importance of establishing bedtime routines, with three (17.6%) advising parents to give a bath to their infant, two (11.8%) advising parents to give a massage to their infants and 12 (70.6%) suggesting the use of white noise. Three (17.6%) applications suggested reducing the light and the social interaction at night and four (23.5%) suggested differentiating daytime and night time. In relation to sleep training strategies only two (11.8%) applications talked about the controlled crying strategy, one (5.9%) about the cry it out strategy and one (5.9%) about the camping out strategy. Positive behavior methods where not discussed at all. Seven (41.7%) applications provided parents with sleep tracking charts, however only one (5.9%) explained the importance of tracking an infant's sleep. Finally, one (5.9%) application suggested that parents should put the infant to bed while still awake in order to learn to fall asleep in the crib. There were three topics that were not discussed at all: continuation of bed sharing after the first few weeks may lead the infant to continue waking up and signaling during the night; quieting an infant in a crib or similar place and avoiding feeding or cuddling them to sleep; and delaying feeding for a while after six weeks of age when infants wake up at night. Table 18 presents these results.

Table 18

Frequency of the topics discussed in applications from App store (content evaluation)

Topic	Subtopic	Frequency	Percent
General information about sleep and crying patterns in infants	Infant sleep cycles explained	4	23.5%
	Infant sleep development explained	4	23.5%
	Infant crying cycles explained	2	11.8%

In the first weeks use lots of carrying and close physical contact between parents and infants to minimize crying at this age		2	11.8%
Bed sharing	Bed sharing is not recommended	1	5.9%
	If used infants should be put to sleep on their backs or sides	2	11.8%
	Continuation of bed sharing after the first few weeks may lead the infant to continue wake up and signal during the night	0	0.0%
Bedtime routines	Importance of establishing bedtime routines	4	23.5%
	Give a bath to your infant (with or without lavender oil)	3	17.6%
	Give a massage to your infant (with or without lavender oil)	2	11.8%
	Play a white noise but keep the volume down	12	70.6%
Quiet an infant in a crib or similar place and avoid feeding or cuddling them to sleep		0	0.0%
Reduce the light and the social interaction at night		3	17.6%
Differentiate daytime and night time		4	23.5%
After six weeks of age delay feeding for a while when infants wake up at night		0	0.0%
Sleep training strategies	Controlled crying or graduated extinction	2	11.8%
	Cry it out	1	5.9%
	Positive behavior methods	0	0.0%
	Extinction with Parental Presence or Camping out (parents have minimum interaction)	1	5.9%

Tracking of infant's sleep	Explanation of importance	1	5.9%
	Provide charts and/or sleep diaries	7	41.2%
Put infant to crib while still awake		1	5.9%
Total		17	100.0%

The second criterion of our evaluation was whether an expert had contributed to the making of the content of the applications. The maximum score obtained was 9, which was the highest score an application could obtain, and the minimum score was 2. The mean score was 2.71 (*SD* = 1.72). Table 19 summarizes these results.

Table 19

Descriptive statistics of the total score of applications from App Store (expert contribution evaluation)

Mean	Std. Deviation	Minimum	Maximum	N
2.71	1.72	2	9	17

In more detail, our data showed that 12 (70.6%) applications scored 2, three (17.6%) scored 3, one (5.9%) scored 4 and one (5.9%) scored 9 (Table 20). No application scored below 2. However, the majority of the applications scored 2. Based on these data only one application had excellent expert contribution. The remaining 16 applications had poor expert contribution (see Appendix B for more information).

Table 20

Total score of applications from App Store (expert contribution evaluation)

Total score	Total score in percentage	Frequency	Percent

2	22.22%	12	70.6%
3	33.33%	3	17.6%
4	44.44%	1	5.9%
9	100.0%	1	5.9%
Total		17	100.0%

Table 21 presents the score of each application for each criterion of the expert contribution evaluation. All the applications had information about the ownership of the application and the last modification date. However, only five (29.4%) of the applications had been updated or modified in the last month during the time of the evaluation. The sources of the information provided in the application were listed only in two applications (11.8%), while only one (5.9%) application provided references. Finally, only one (5.9%) mentioned the author of the provided information and listed his/her credentials and affiliations. Only one (5.9%) application mentioned its sponsors.

Table 21

Scores of applications from App Store on each criterion (expert contribution evaluation)

Criterion	Frequency	Percent
Authors credited	1	5.9%
Author's affiliations	1	5.9%
Author's credentials	1	5.9%

Information sources	2	11.8%
References given	1	5.9%
App ownership disclosed	17	100.0%
Sponsorship disclosed	1	5.9%
App modified in the previous month	5	29.4%
Creation of last modification date specified	17	100.0%

Discussion

The purpose of this study was to evaluate parenting websites and applications (both from the Play store and the App store) in terms of the information they provided about infant sleeping and crying problems and whether an expert (for example a health-care professional) had contributed in the making of the content. This means that apart from examining what was discussed in these websites and applications we also wanted to know if the information provided was accompanied by the author's credentials and affiliations and whether the references or the sources of the information were clearly stated. It is important to explore whether parenting websites and applications provide evidence based information, as studies have found that many people who search for health-related information online do not check the source of the information. In one study, the authors explain that this might be due to the easiness of locating online information, which then makes the information-seekers forget about the importance of checking the source of the information (Fox & Reinie, 2002). If parents of infants follow the same strategy, it can be dangerous for the health of their infants, as they might trust and use an inaccurate advice. Thus, parents should learn to evaluate the trustworthiness of the information they obtain online, especially when it is related to the health of their infants. With our study, we tried to provide an evaluation of the most popular

parenting websites and applications in terms of the information they provide in relation to infant sleeping and crying problems. In total, we evaluated 24 websites, 15 Android applications (Play store) and 17 iOS applications (App store). Our results suggest that the majority of the websites and the applications had poor content and poor expert contribution.

Starting with the websites, our data showed that the content of all the websites was poor. This might be related to the classification of the total score we used. According to this classification applications that scored below 75% were perceived as having poor content. There were three applications (Parenting Science, Parents, Baby Center) that were rated with a total score of 72.7% for their content but this score was not enough to classify them as having adequate content. However, the same classification system was used in the study of Taki et. al (2015) where they evaluated feeding websites and applications for infants. Their results also suggested that the majority of the evaluated applications and websites had poor content. As in the study of Taki et al (2015), no website that was evaluated in our study provided information about all the topics we examined in relation to infant sleeping and crying problems. The most discussed topics were general information about infant sleep cycles (22 websites) and infant sleep development (23 websites), establishing bedtime routines (23 websites) and using white noise as part of an effective bedtime routine (20 websites).

The criterion of the expert contribution was assessed based on a set of 7 criteria used in similar studies (Bohacek et al., 2003; Martins and Morse, 2005). In the studies of Bohacek et al. (2003) and Martins and Morse (2005) the contribution of an expert was fair or poor in the majority of the websites that were evaluated. Similarly, in our study we found varying results in relation to the expert contribution in the making of the content. The majority of the evaluated websites were classified as having poor expert contribution. However, four had fair expert contribution, one good expert contribution and four had excellent expert contribution. The websites with the excellent expert contribution were Parenting Science, Baby Center, Very Well Family and Precious Little Sleep (see Appendix B for more details).

The evaluation of the applications from the Play store revealed that all applications had poor quality. First, we evaluated the topics that were discussed in these applications in relation to infant sleeping and crying problems. Our evaluation showed that the content of all the applications was poor. This result is similar to the result we obtained from the evaluation of the content of the websites. Again, a possible explanation could be that the classification system was very strict as applications that scored below 75% were classified as having poor content. The maximum total score we obtained from the evaluation of the applications was

59.1%, even lower than that of the websites. This score was obtained from the Baby Center application. Another possible explanation for the poor content quality is that the majority of the applications were merely tracking applications or applications providing a selection of white noise. It is to be expected that an application cannot present the same amount of information as is possible on a website, but almost none of the applications we evaluated provided a satisfactory amount of information about infant sleeping or crying problems. In addition, sleep training strategies were addressed in only one application from the Play store and in only two applications from the App store.

In relation to the expert contribution evaluation, we used the same set of criteria as in a previous study evaluating infant feeding applications (Zhao et al., 2017). According to our results, only one application was classified as having excellent expert contribution while the remaining 14 were classified as having poor expert contribution. This is similar to the results obtained in the study of Zhao et al. (2017), were it was found that the majority of the evaluated applications was lacking a scientific basis. In our study, the only application with excellent expert contribution was the Baby Center application. This application was the only one that listed the name of the author, his/her credentials and affiliations, references and information sources for each piece of information found in the application.

Finally, our evaluation of the applications from the App store resulted in similar findings. The evaluation of the topics discussed in these applications showed that the content of all the applications was poor. As in the case of the evaluation of the applications from the Play store and the websites, an explanation for this result could be the strict classification system we used and the fact that the majority of the applications from the App store were merely tracking applications and applications providing white noise. A surprising result is that 11 out of the 17 iOS applications we evaluated scored only 1 point out of the possible 22. This is again related to the fact that these applications did not provide a satisfactory amount of information or advice in relation to infant sleeping and crying problems. Thus, the extremely low score that these applications obtained can be justified. In total, 12 applications were only providing types of white noise and seven were sleep tracking applications, but none of these applications provided information about the reasons for using white noise as part of a bedtime routine or the importance of tracking infant sleep.

With regards to the expert contribution evaluation only one application was rated as having excellent expert contribution, while the remaining 16 were classified as having poor expert contribution. This result is similar to the result we obtained from the evaluation of the applications from the Play store. There was only one application in the evaluation of the

Android applications that had excellent expert contribution. In fact, the application that was classified as having excellent expert contribution in the Play store evaluation and in the App store evaluation was the same (Baby Center). In addition, Baby Center was the only source of information about infant sleeping and crying problems that was found in both the website evaluation and the application evaluation (Play store and App store). In the website evaluation Baby Center was also rated as having excellent expert contribution.

Apart from the Baby Center application, three other applications were found in both markets (Play store and App store): the Baby Tracker - Newborn Feeding, Diaper, Sleep log: the Feed Baby - Breastfeeding App, and the White Noise Baby Lite. However, in our evaluation these applications were classified as having poor content and poor expert contribution in both markets (Play store and App store).

Our results are in line with results obtained by similar studies. Scott et al. (2014) evaluated 10 parenting applications and only four of them had proof that a health-care professional had contributed in the making of their content. This is similar to our results, according to which only one application listed the author's name, affiliations and credentials. Of the 24 websites we evaluated, only four had proof that a health-care professional had contributed in the making of the content, while in nine websites the author of the articles had no officially recognized experience and in 11 the information of the authors was unclear. In addition, in the study of Scott et al. (2014) only four applications had evidence-based content, while in our study the majority of the applications were rated as having poor content.

Our findings are similar to the results found in the study of Davis et al. (2017). In their study Davis et al. (2017) found that although the majority of the health related websites they evaluated had links to medical articles or to websites, 23% of the websites listed no references. This result is similar to our results, where 5 (20.8%) of the 24 websites we evaluated provided no references at all. However, in our study 11 websites provided references for some of the presented information and eight provided references for all the information they presented.

Another finding we obtained which is similar to the findings of previous research is the information provided about the author's name, affiliations and credentials. Zhao et al. (2017) found that only one of the applications they evaluated listed the name of the author of the information found in the applications and his affiliations. Similarly, in our study we found that only one application (which was the same application for the Play store and the App store) listed the name of the author of the information in the applications, his affiliations and his credentials. Moreover, in the parenting websites we evaluated, 20 of them had some

information about the author, but the majority of these authors had no officially recognized experience. Taki et al. (2015), also found that from the 44 websites and the 46 applications they evaluated, only 11 websites listed the author's qualifications and only nine applications listed the author's name. These results may suggest that the author's name, qualifications and credentials are rarely mentioned in parenting websites and applications. This makes the provided information extremely unreliable, especially when we are dealing with health-related information about infants. Finally, in the study of Taki et al. (2015), it was found that the evaluated websites provided more information about infant feeding and a bigger variety of topics related to infant feeding than the applications. This result is similar to the result of our study, as the websites we evaluated addressed more topics in relation to infant sleeping and crying problems than the applications. Websites addressed 3-16 of the 22 topics we evaluated, while applications (both from the Play store and the App store) addressed 0-13 of the 22 topics.

Limitations

In general, our findings show that developers of parenting applications and creators of parenting websites are lacking in their use of evidence-based information in their products and would be wise to recruit health-care professionals or experts to assist them in the making of the content of their applications and websites. However, our study has some limitations.

The first limitation is related to the sample of the websites and the applications we evaluated. In our study we evaluated a selection of parenting websites and applications based on specific inclusion criteria. One of these criteria was that we only included websites and applications that were written in English. If different criteria were used (for example selecting websites and applications in a different language) it is possible that we would have obtained different results. Thus, our results can not be generalized to all parenting applications and websites. In addition, the majority of the applications are updated on a monthly basis and new articles are being added on websites regularly. This means that if we would replicate this study in a few months we could obtain very different results as new information might have been added or corrections could have been made.

Moreover, we only evaluated the most popular websites and applications. To make this selection we used the rating of the applications in the Play store and the App store and the order of the websites listed in the results pages of the Google and Bing search engines. However, the rating of the applications is based on the ratings of users and the fact that an

application is highly rated by its users might not necessarily say anything about the quality of the application. This is something that was partly verified in our results, as all the applications we evaluated had a user-rating of 4 stars or higher, but the majority of them were of poor quality according to our standards. Thus, if different search engines are used and different inclusion criteria are formulated we might end up with a different sample of applications and websites. In addition, if future studies include applications with a lower rating (for example 3 stars), it is possible that we will obtain different results.

Finally, as mentioned before the rating and classification systems we used for the evaluation of the content of the websites and the applications proved to be quite strict. Thus, the majority of the applications and the websites were rated as having poor content. Results from similar studies also revealed that the quality of the majority of parenting applications and websites was poor. In fact, in one study evaluating websites that provide information about safe infant sleep, it was found that of the 1300 websites 28% of them provided inaccurate information (Chung, Oden, Joyner, Sims & Moon, 2012). This percentage is extremely high when we evaluate websites providing health-related information for infants. In our study, we decided to use the same rating and classification system as in previous studies, but we might have obtained different results if a different rating and classification system had been used. However, we considered using this classification system necessary, as we were interested in evaluating parenting websites and applications that presented information about infant sleeping and crying problems. In addition, it was found that 49% of mothers of infants have used a parenting application, 19% use a parenting application on a daily basis and 20% use a parenting application every week (Lupton & Pedersen, 2016). The frequent use of digital media to obtain health-related information about infants in combination with the alarming results obtained from studies evaluating parenting applications and websites makes the need for accurate online infant-related information imperative.

Nevertheless, there are two strong points in our research. To begin with, even though the classification system we used was proven to be very strict, it was necessary in order to underline the importance of providing parents with evidence-based information in relation to infant sleeping and crying problems. In addition, the results of our study can be used to inform those involved in the creation of online content in relation to infant health, about the importance of using evidence-based information that is coming from trusted sources.

Moreover, to our knowledge there is no other study that evaluated parenting websites and applications that were specifically about infant sleeping and crying problems. Although

there is some research that evaluated health related information about infant care or infant feeding (Zhao et al., 2017, Taki et al. 2015), no previous study has looked at infant sleeping and crying problems specifically.

Future directions

It becomes clear that more research is needed on the field of evaluating health related information found online or in applications, especially when this information is about infant sleeping and crying problems. Especially, nowadays, considering the tremendous increase in the number of applications and websites that are created, there is a need for developing a universal tool that could be used to assess the quality of health related information found on digital media. In addition, it is essential to educate parents in order to be able to critically select sources of information that present evidence based content. As proven in our study, applications that were quite popular in the Play store and the App store were poor in quality when measured by our standards. A universal grading system based on content and source of information could help parents learn to critically select the parenting websites and applications they can trust for retrieving health-related information about the treatment of their infants.

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Appendix

Appendix A

Table A1

Evaluation form of evidenced-based content - Websites and Applications

	Topics		Points
1.	General information about sleep and crying patterns in infants**	● Infant sleep cycles explained** ● Infant sleep development explained** ● Infant crying cycles explained**	(maximum points 3)
2.	In the first weeks use lots of carrying and close physical contact between parents and infants to minimize crying at this age*		(maximum points 1)
3.	Bed sharing*	● Bed sharing is not recommended* ● If used infants should be put to sleep on their backs or sides* ● Continuation of bed sharing after the first few weeks may lead the infant to continue wake up and signal during the night*	(maximum points 3)

4.	Bedtime routines**	● Establish bedtime routines** ● Give a bath to your infant (using lavender oil is recommended)** ● Give a massage to your infant (using lavender oil is recommended)** ● Play a white noise but the keep the volume down**	(maximum points 4)
5.	Quiet an infant in a crib or similar place and avoid feeding or cuddling them to sleep*		(maximum points 1)
6.	Reduce the light and the social interaction at night*		(maximum points 1)
7.	Differentiate daytime and night time**		(maximum points 1)
8.	After six weeks of age delay feeding for a while when infants wake up at night*		(maximum points 1)
9.	Sleep training strategies	● Controlled crying or graduated extinction** ● Cry it out ● Positive behavior methods* ● Extinction with Parental Presence or Camping out	(maximum points 4)

10. Tracking of infant's sleep**	• Explanation of importance** • Provide charts and/or sleep diaries**	(maximum points 2)
11. Put infant to crib while still awake**		(maximum points 1)
Total points (maximum points 22)		

Note. Scoring system: Topic discussed (+1), Topic not discussed (0), * = Recommendations taken by reference 44, ** = Recommendations adjusted from the literature review of the interventions.

Table A2

Evaluation form of expert contribution - Websites

	Scoring system	Points
Ownership	No indication of ownership/sponsorship	0
	Ownership/sponsorship clearly stated	1
Purpose	No statement of purpose	0
	Purpose stated as educational but the financial profit from use of the site exists	1
	Distinction is made as to whether the information provided is for commercial purposes or educational purposes, or both	2
Authorship	No indication of authorship	0
	All other indications of authorship	1

Author qualification	Author has no officially recognized experience in the field or no such information is provided	0
	Information about the author's professional qualification is vague, or if the author has no professional experience but has direct personal experience (ROP patient)	1
	If author is a health-care professional	2
Attribution	No references provided for requiring statements	0
	References are provided for some, but not all, statements requiring factual information	1
	Attribution for all statements conveying factual information is present	2
Interactivity	No contact provided	0
	Telephone number, email, or mailing address provided	1
	Clear invitation to comment or ask questions by an email address or link to a form	2
Currency	No date provided	0
	Date of original posting provided, but no information about the date of last revisal or frequency of updates	1
	Date of original posting and date of last revisal or frequency of updates clearly stated	2
Total Points (maximum points 13)		

Table A3

Evaluation form of expert contribution - Applications

Scoring system	Points

Authors credited	Maximum points 1
Author's affiliations**	Maximum points 1
Author's credentials*	Maximum points 1
Information sources	Maximum points 1
References given	Maximum points 1
App ownership disclosed	Maximum points 1
Sponsorship disclosed	Maximum points 1
App modified in the previous month	Maximum points 1
Creation of last modification date specified	Maximum points 1
Total Points (maximum 9 points)	

Note. * = Is the author's education in the subject area in which they are writing?, * = Has the author written other books or articles on the same or a similar topic?, * = Is the book, article, Web site written in the author's field of expertise?, ** = authors will list their affiliation, usually with a university or research institution

Appendix B

Table B1

Classification of websites based on expert contribution in the making of the content

Websites with poor expert contribution	Link to website
Parents	https://www.parents.com/
Baby Sleep Site	https://www.babysleepsite.com/
Little Ones	https://www.littleones.co/
Baby Sleep Science	https://www.babysleepscience.com/

Oh Baby Magazine	https://www.ohbabymagazine.com/
Zero To Three	https://www.zerotothree.org/
Today's Parents	https://www.todaysparent.com/
What To Expect	https://www.whattoexpect.com/
My Baby Sleep Guide	http://www.mybabysleepguide.com/
Kid Spot	https://www.kidspot.com.au/
The Bump	https://www.thebump.com/
Rookie Moms	https://www.rookiemoms.com/
Parenting Healthy Babies	https://parentinghealthybabies.com/
Mother And Baby	https://www.motherandbaby.co.uk/
Healthy Children	https://www.healthychildren.org
Websites with fair expert contribution	Link to website
Raising Children	http://raisingchildren.net.au/
Purple Crying	http://www.purplecrying.info/
Sleep Baby Love	https://www.sleepbabylove.com/
Belly Belly	https://www.bellybelly.com.au/
Websites with good expert contribution	Link to website
Ask DR Sears	https://www.askdrsears.com/
Websites with excellent expert contribution	Link to website
Parenting Science	https://www.parentingscience.com/
Baby Center	https://www.babycenter.com/
Very Well Family	https://www.verywellfamily.com/
Precious Little Sleep	https://www.preciouslittlesleep.com/

Table B2

Classification of applications (Play store) based on expert contribution in the making of the content

Applications with poor expert contribution
Baby Daybook - Tracking of breastfeeding and care
Baby Care
Baby Sleep: White noise lullabies for newborns
Baby Manager - Baby Tracker & Breastfeeding track
Baby Sleep - White Noise
BabyTime (Parenting, Track & Analysis)
Baby tracker - feeding, sleep and diaper
Baby Tracker - Newborn Feeding, Diaper, Sleep log
Night Light for Baby. Instant Sleep. White Noise
White Noise Lite
Feed Baby - Baby Tracker
White Noise Baby Sleep Sounds
White Noise Baby
Indian Pregnancy & Parenting tips, The Babycare App
Applications with excellent expert contribution
Pregnancy Tracker & Countdown to Baby due date (Baby Center)

Table B3

Classification of applications (App store) based on expert contribution in the making of the content

Applications with poor expert contribution
Sprout Baby
Baby tracker
Awesome baby tracker
Feed Baby - Breastfeeding App
Baby tracker
Sound Sleeper: White Noise
Sleeptot - baby white noise
Baby Sleep
Baby sleep sounds - Guva plus
Sleepy sounds
Baby+
Baby Tracker - Newborn Care
Colic Baby
Vacuum cleaner sounds for baby
White noise baby Lite
Applications with excellent expert contribution
Baby Center