



Analysis of parenting informational needs for mothers with infants and toddlers using text-mining

Sunhwa Park^a, Kyungja June^{b,d}, Jungok Yu^{c,*}

^a Department of Nursing, Chung Cheong University, Cheongju, Republic of Korea

^b Institute of Health Policy and Management, Seoul National University College of Medicine, Seoul, Republic of Korea

^c College of Nursing, Dong-A University, Busan, Republic of Korea

^d The Support Team for the Early Life Health Management Program, Seoul, Republic of Korea

ARTICLE INFO

Keywords:

Parenting
Mothers
Infant
Toddler
Text-mining

ABSTRACT

Due to its accessibility and anonymity, the Internet is a common way for mothers to find information about parenting concerns. The purpose of this study was to explore the parenting questions posted by mothers on parenting online communities to identify the informational needs of parents with young children. We analyzed 31,565 parenting-related questions posted in October 2019. Text mining was performed using Latent Dirichlet Allocation (LDA) to identify the most common topics in the dataset. Topics were sorted according to infant age group and a keyword network analysis was performed to identify parenting difficulties. In the LDA, 15 topics were found to be the best-fitting model. From these, we identified parenting situations that lead to many questions, the majority of which were focused on basic childcare related to feeding, baby food, sleeping, medical problems, development, and learning. The distribution of the 15 topics varies according to age group. Keyword network analysis showed that mothers had difficulty putting their babies to sleep and stopping them from crying. This study provides useful information to support parenting and makes suggestions for how parenting programs can meet mothers' needs.

1. Introduction

After childbirth, mothers experience maternal role attainment. Mercer (2004) replaced the term, maternal role attainment, with “becoming a mother” (BAM) to suggest that mothers' growth and process of becoming a mother is continuous. Studies show that it takes approximately-four months from childbirth to maternal identity integration (Mercer, 2004), but even after this period, mothers complain of parenting difficulties as they continue to perform childcare as the baby develops. In particular, mothers with babies under 36 months of age struggle more with parenting. Since children are entirely dependent upon the primary caregiver for daily life during this period and mothers must respond immediately to their babies' needs, mothers are under stress physically and psychologically (Barlow et al., 2010).

With a rapidly changing society and family nuclearization, parents are entirely responsible for childrearing. It is difficult for parents today to learn about a parent's role or get immediate help, knowledge, and experience regarding parenting from their families. According to the 2020 Family Status Survey in Korea, 87.4 % of the primary caregivers

for infants and toddlers were mothers, indicating that parenting is delegated to mothers of infants and toddlers (Statistics Korea, 2021a). Due to the influence of this social culture, there is the newly created term, 'Dok-Bak parenting' has been used in Korea. It means that the mothers take care of the children by themselves even though they might have a husband (National Institute of Korean Language, 2022). The dedicating responsibility for childcare is dedicated to mothers only. Presently, the total fertility rate in Korea is 0.81 which is the lowest in the world (Statistics Korea, 2021b). This may be owing to the high tendency to avoid childbirth and childcare in recognition of the difficulties and hardships of parenting.

Hence, a medium is necessary that mothers can use to find solutions easily and rapidly to the problems and difficulties they experience in parenting and can search for parenting information. In a study in Korea in 2014, it was found that 59 % of mothers received the information they needed from the Internet, making it the most reliable way of obtaining parenting information (Min et al., 2014). In internet parenting communities, interactive communication occurs immediately. Thus, a parenting difficulty or problem can be resolved in real-time and users

* Corresponding author.

E-mail addresses: shpark3213@mkc.ac.kr (S. Park), kjajune@sch.ac.kr (K. June), joyu@dau.ac.kr (J. Yu).

can obtain rich information quickly at any place and time (Moon et al., 2019). Additionally, internet-parenting community members play the role of an emotional supporter, as mothers raising children of a similar age understand, empathize, encourage, and console one another (Kim et al., 2017). Thus, internet parenting communities have academic value in identifying mothers' diverse informational needs in parenting and offer considerable opportunities to create a blueprint for tailoring parenting interventions. However, research that investigates mothers' informational parenting needs by analyzing Internet data, such as internet parenting communities is limited in Korea.

Previous studies have examined online postings related to raising infants and toddlers (Lebron, 2020; Porter & Ispa, 2013; Yamada et al., 2019), but they analyzed small volumes of data using qualitative methodology. This type of analysis takes a lot of time and effort (Yoon, 2019), making it difficult to analyze large volumes of data.

To overcome these limitations, text-mining methods have recently been used in studies. Text mining such as Latent Dirichlet Allocation (LDA) is an approach used to analyze morphemes without a pre-determined coding system, unlike content analysis. LDA aims to reveal new relationships and meanings naturally from the data based on word frequency and the pattern of associated words (Blei et al., 2003) and is not based on the researchers' assumptions, thus reducing researcher bias. Additionally, the text mining approach is highly efficient because it can handle large volumes of data. Recently, a study was conducted to analyze a large volume of SNS data on parenting stress by using a text mining technique (Ahn et al., 2020). It identified parenting difficulties in balancing work and home life and gender issues as the main topics pertaining to parenting stress.

This study aims to identify topics related to the parenting informational needs of mothers with infants/toddlers using text-mining. This study examined questions posted in the most active parenting community in Korea to explore the following research questions.

- (1) What are the parenting informational needs of Korean mothers with infants and toddlers posted on the Internet parenting community?
- (2) What are parenting informational needs at different age stages?
- (3) What are the topics that mothers find difficult related to parenting?

2. Methods

2.1. Data sources

The current study used publicly available data from the online parenting community, Momsholic Baby (<https://cafe.naver.com/imsanbu>). Momsholic Baby is the top pregnancy/childbirth/parenting community in Korea, with 2,840,000 registered members and 800,000 visitors per day as of December 2019. The question posting board at Momsholic Baby is divided into three rooms: pregnancy, childbirth, and parenting. We selected the parenting question board.

The scope of the data was limited to questions posted over one month from October 1 to October 30, 2019. For data collection, web scraping was performed to obtain text data by using "httr," "rvest," "stringr," and "RSelenium" packages in R (ver 4.0.2). The uniform resource locator (URL) of the community board page was called in program R and saved as HTML. Among the data contained in the HTML, the text of the nodes with the titles and content of the posts were extracted. The post's collected title and content were stored in CSV (Comma-Separated Values) format. This data extraction was performed several times until all data from the set period were collected. There were a total of 58,029 posts during the aforementioned period. To identify parenting informational needs according to the baby's developmental phase, postings where age information was not found ($n = 25,012$) and postings by mothers with children older than 36 months ($n = 1313$) were excluded from the analysis. Additionally, 139 were excluded during

morphological analysis and data cleaning because the posted text was too short; so, a total of 31,565 posts were included in the final analysis.

2.2. Ethical considerations

This study examined text data from an internet community board. The board was anonymously operated and the scope of the data collected for the study included question titles and text, which did not contain personal information such as the questioner's username. The study was approved by the Dong-A Institutional Review Board (202007-HR-030-02).

2.3. Data analysis

The data were preprocessed and analyzed using R version 4.0.2. The steps of the analytical procedure are shown in Fig. 1.

(1) Text preprocessing

Since the collected data were an unstructured set of documents, text preprocessing was performed to transform the documents into a pattern from which information could be extracted. In order to get the computer to understand any text, each word in the text needs to be broken down in a way that the computer can understand. To do so, first, a morphological analysis was conducted. The "NLP4kec 1.4.0" package (<https://github.com/NamyounKim/NLP4kec>) was used to perform Korean natural language processing (NLP). NLP4kec 1.4.0 is based on MeCab (<https://eunjeon.blogspot.kr>), an open-source morphological analyzer for Koreans.

The file storing the analyzed morphemes was preprocessed by using the "tm" package in R. After the file was converted to a corpus, punctuation marks, special symbols, and numbers were removed, and particular words that were meaningless and unnecessary for analysis (e.g., do, am/is, becomes) were treated as stop-words.

(2) Word extraction

After data preprocessing, each document consisting of several morphemes was stored in a document-term matrix (DTM). DTM is a matrix where each row represents one document (each post in our research), each column represents one term, and each value contains the number of appearances of that term in that document (Silge & Robinson, 2017). After data cleaning was completed, 16,031 words were extracted. To screen out low-frequency words, sparse terms that did not appear in 99.0 % or more of the documents were removed. To address the drawback of analyzing word importance based simply on frequency, term frequency and inverse document frequency (TF-IDF), a word weighting method, was applied to check for words with a low TF-IDF value. The statistic TF-IDF is intended to measure how important a word is to a document in a collection of documents. Finally, a DTM containing the 303 most frequently used terms from the corpus was obtained.

(3) Latent Dirichlet Allocation (LDA) topic modeling

Topic modeling is a process in which an unstructured set of documents is structurally organized based on the final chosen semantic information. In this approach, it is possible to identify topics and characteristics in the entire dataset by classifying the documents into several small groups according to content similarity (Back, 2017). Once topics are generated based on words with a high co-occurrence frequency in the set of documents, the researchers assign a label to each of the topics to reflect their interpretation. In this study, Latent Dirichlet Allocation (LDA; Blei et al., 2003), the most commonly used technique in topic modeling, was applied by using "topicmodels" and "LDavis" R packages. LDA is guided by two principles. First, every document is a mixture of topics. Each document may contain words from several topics

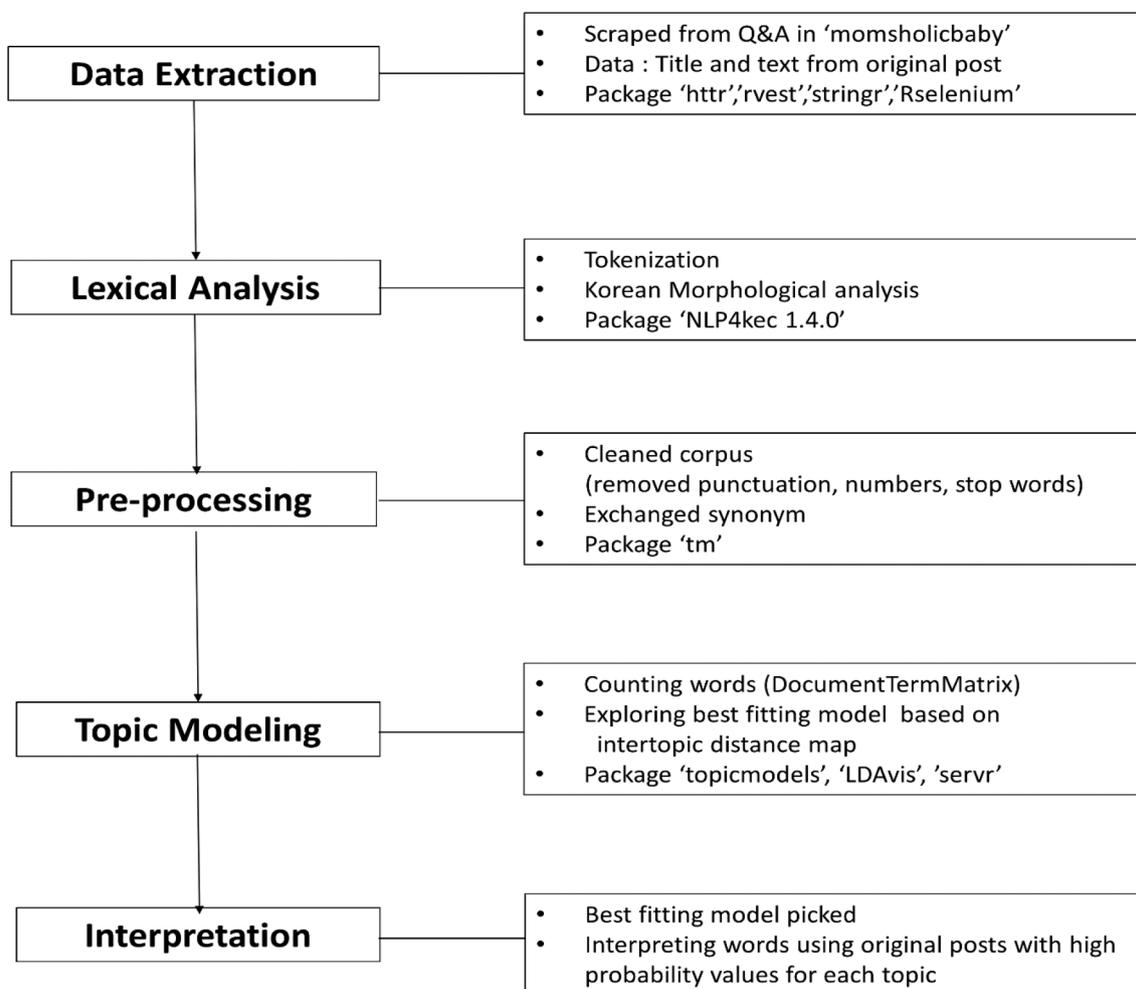


Fig. 1. Data processing and analysis pipeline.

in particular proportions. For example, in a two-topic model 'Document 1 is 90 % topic A and 10 % topic B, while Document 2 is 30 % topic A and 70 % topic B'. Second, every topic is a mixture of words. Importantly, words can be shared between topics. LDA is a mathematical method for estimating both of these at the same time: finding the mixture of words that are associated with each topic, while also determining the mixture of topics that describes each document (Silge & Robinson, 2017).

To extract topics using LDA, the number of topics should be predetermined. Since the number is estimated by the researchers, the appropriateness of the estimated number of topics should be justifiable (Blei et al., 2003). Hence, to determine an appropriate number of topics for the study, a range of numbers, from eight to 25, were tested by repeatedly performing LDA topic modeling with each of the values for the number of topics and by comparing the results. For this work, LDAvis, a module for LDA topic modeling visualization, was used to generate multidimensional intertopic distance maps and visually inspect the similarities between topics. Considering low intertopic overlapping and the interpretability of topics, 15 topics were determined to be appropriate (Supplementary Fig. 1). LDA outputs include keywords per topic, the probability distribution of topics per document, and topic numbers per document. In this study, 20 main keywords were extracted for each topic, and topic probabilities and the topic number with the highest probability per document were output. Documents with high probabilities of the topics were reviewed, and each topic was assigned a label by considering its relationships with the extracted words.

(4) The distribution of topics according to infant/toddler age

To investigate differences in mothers' questions depending on infant/toddler age in months, the data classified into the topics were linked to the raw data containing age information to generate the distributions of topics according to the baby's age.

(5) Keyword network analysis

Of the 303 words used in the analysis, 11 words revealing the feelings or thoughts of mothers with infants/toddlers (concern, consider, hard, crazy, exhausted, ignorant, curious, difficult, frustrated, scared, and upset) were identified. To explore the words with a correlation coefficient of 0.1 or higher with any of the 11 words, related-keyword network analysis was performed, and network maps were generated to visualize the results by using "tm," "igraph," "network," "sna," "GGally," and "ggplot2" packages available in R ver 4.0.2.

3. Results

3.1. Topics and keywords per topic in parenting-related questions of mothers with infants/toddlers

Table 1 lists 15 topics in parenting-related questions that were derived by LDA topic modeling and the 20 most frequently occurring words per topic. Based on the question postings categorized under a topic by referring to keywords and the highest probability value, the main findings per topic were as follows.

Topic 1 was play and learning, with questions primarily concerning

Table 1
The 20 most probable words and samples of original questions in LDA topics with 15 topics.

Topic	Topic themes	Words
T1	Play and Learning	play, mom, daycare center, husband, drop off, ride, attend, hate, going out, idea, dad, where, alone, parenting, man, toy, hard, story, laugh, parents' home
T2	Excrement	poo, formula milk, change, diapers, burp, lactobacilli, throw up, shit, colic, change, diarrhea, make, constipation, digestion, fart, postpartum care center, smell, greenish stool, pee, watery
T3	Sleep	sleep, wake, put to sleep, lie, dawn, nap, get up, deep sleep, night sleep, bed, sleepy, train, hard, irritable, put down, pattern, fatigue, habit, late, bath
T4	Feeding amount and Growth	formula milk, amount, increase, height, weight, little, give, many, born, reduce, concern, small, insufficient, consider, supplement, average, advice, frequency, refuse, eat
T5	Breastfeeding	breast milk, feeding, express, feed, direct feeding, exclusive breastfeeding, postnatal care center, mix, suckle, supplement, volume, one side, insufficient, both sides, discharge, refuse, thought, dawn, find, many
T6	Feeding schedule	time, feeding, interval, hungry, long, short, give, whine, set, comply, endure, middle, increase, average, following, hard, problem, wait, find, soothe
T7	Skin troubles	newborn, severe, dress, high, face, appear, apply, emerge, baby carrier, bath, skin, leg, congenital fever, clean, part, position, drool, chilly, red, discomfort
T8	Medical problems	well, hospital, concern, flu, sit, pediatrics, down, nasal discharge, cough, examination, prescription, rest, symptom, walk, stand, touch, floor, bump, head, fever reducer
T9	Weaning	weaning food, start, step, give, snack, stage1, pass, stage2, make, refuse, solid, stage3, put, beef, fruit, cheese, commercial, eat, late, ignorant
T10	Vaccination	come out, appropriate, pain, ask, vaccination, delactation, breast, full, massage, deliver, feel, inject, influenza, produce, hard, many, ignorant, mind, beginning, upset
T11	Book recommendations and Child development	good, buy, book, hear, show, sound, overturn, recommend, head, raise, thought, many, consider, inferior, late, all day, turn, read, need, time
T12	Night feeding	exceed, pass, morning, wonder, cut, usual, evening, midnight feeding, between, afternoon, different, morning, share, get up, find, helper, set, pattern, dawn, concern
T13	Finger sucking	big, when, suck, irritation, how, pull, inform, insert, born, better, how, next, small, help, advice, remove, spit, finger, concern, difference
T14	Baby cries	cry, use, feeding bottle, method, hard, pacifier, snuggle, soothe, moment, crazy, size, bawl, refuse, problem, reason, raise, ignorant, irritable, try, exhausted
T15	Solid food	eat, cow's milk, vomit, middle, little, stress, spit, concern, beginning, ignorant, problem, give, find, formula milk, make, cut, woman, refuse, habit, help

when to send one's baby to a daycare center and how to choose one as well as playing methods such as how to play with the babies. Topic 2 was excrement. Many questions were regarding whether the baby's stool condition (such as green color and watery) was considered normal. Some questions were about whether to change baby formula brands and

which brand would be good assuming that the baby's stool condition was due to the current brand. Topic 3 was sleep. Many questions under this topic were about how to train babies to sleep. Mothers were battling as their babies did not fall asleep quickly, always had to be held when put to sleep, or did not sleep lying in their own bed. Questions also focused on how mothers can encourage babies to have longer sleep at night. Topic 4 was regarding the volume of baby formula and growth. In many questions, mothers wanted confirmation about whether the current volume of baby formula per feeding time or per day was suitable according to the baby's growth status (weight). Topic 5 was breastfeeding. Questions focused on how to get a good breastfeeding latch, what to do if the baby fell asleep after just one breast, how to increase the amount of breastmilk, how to know if the baby was getting enough milk, how to use a breast pump kit, how to store expressed breastmilk, and how to feed the baby with expressed breastmilk. Topic 6 was feeding schedule, with questions like whether the current feeding schedule was appropriate, whether to feed the baby whenever they wanted to eat or at fixed intervals, whether to wake up the baby to feed it on time, and how to increase feeding intervals. Topic 7 included questions about skin troubles, such as whether the baby's skin condition was infantile atopic dermatitis and how to address it. Additionally, there were many requests for confirmation on whether seborrheic dermatitis, heat rash, or atopy is the most prevalent skin problem among infants/toddlers. Topic 8 was medical problems. Many questions under this topic were about the significance of unusual physical signs and how to address them, such as whether to take the baby to the hospital when they showed respiratory symptoms like a runny nose and were coughing. Topic 9 was weaning. Mothers shared their daily meal schedule which included weaning and the volume of foods, requesting whether the schedule and amount of food were adequate. Further, there were many questions regarding which ingredients could be fed to babies at early/intermediate/late developmental stages. Questions were also related to recipes for making weaning foods and what to do when the baby did not want to eat weaning foods. Topic 10 was vaccinations. As the data collected for the study were for the entire month of October, there were many questions regarding flu vaccines, primarily concerning when to vaccinate the baby and how to address vaccine side effects like fevers. Topic 11 was about book recommendations and child development. In most of the postings, mothers described the baby's current status and requested book recommendations appropriate to the baby's current developmental phase. Topic 12 was feeding at night. Many questions focused on when to stop night feeding and how this can be done. Topic 13 included questions about when the baby needs to suck things such as a finger, whether it is okay if the baby sucks hands, fingers, and blankets often, and how to encourage babies to stop sucking. Topic 14 questions inquired about how to soothe a crying baby. Mothers asked for advice because they did not understand the reasons for the crying and the baby could not be soothed. Topic 15 was solid food. Primarily, the questions were about what brands of cow's milk to feed the baby 12 months after birth when the babies were weaning off breastmilk or formula and transitioning to cow's milk, what to do when the babies refused to drink cow's milk, and what ingredients to use for side dishes.

The distribution of the number of questions in the 15 derived topics is shown in Fig. 2. Topic 3 (sleep) had the greatest number of questions, followed by Topics 15 (solid food), 1 (play and learning), 8 (medical problems), and 7 (skin troubles). Individually, the frequencies of Topics 4 (the volume of feeding and growth), 5 (breastfeeding), and 6 (feeding schedule), that is, topics pertaining to feeding, were not high compared to others. However, when they were combined into a single topic pertaining to baby feeding, the combination showed the highest frequency.

3.2. The distributions of topics according to infant/toddler age

The distribution of questions for each topic according to the baby's age in months is presented in Fig. 3 and Supplementary Table 1. Mothers with 0–1-month-old infants most frequently asked questions regarding

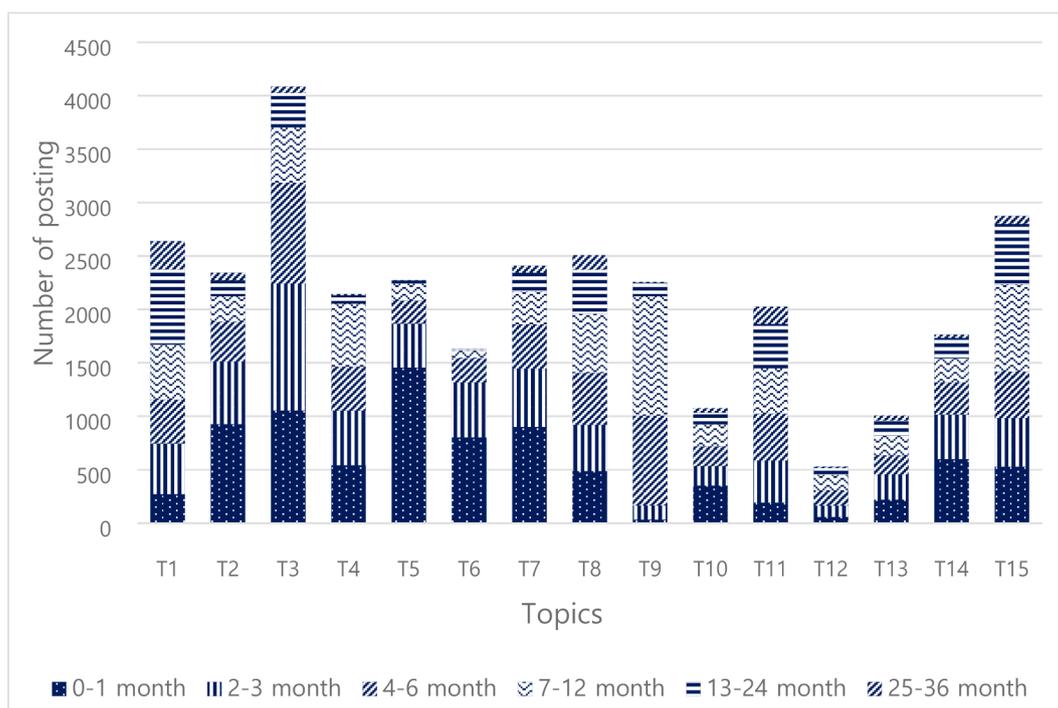


Fig. 2. Distribution of assigned topics with the highest probability for posting.

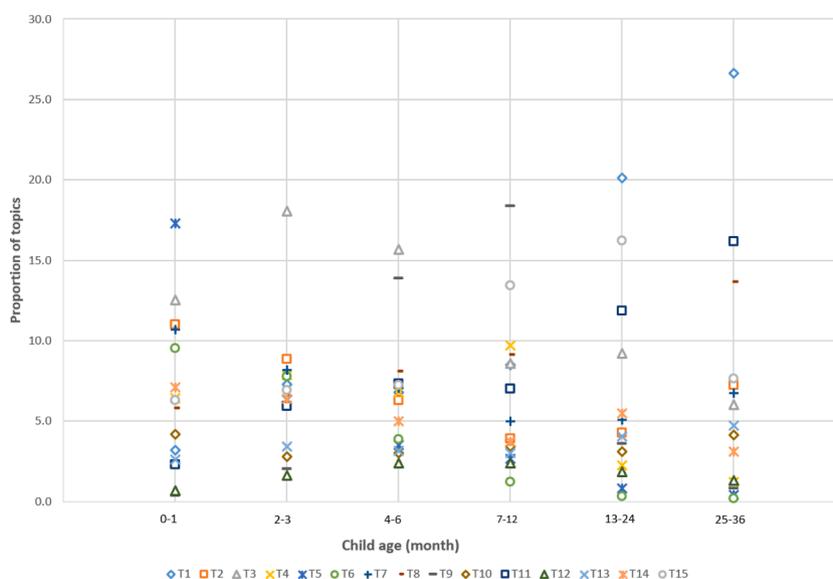


Fig. 3. The distributions of topics according to infant/toddler age.

breastfeeding (T5, 17.3 %), followed by sleep (T3, 12.5 %), excrement (T2, 11.0 %), and skin (T7, 10.7 %). Questions regarding the feeding schedule (T6, 9.5 %) and the amount of feeding and growth (T4, 6.4 %) were fewer, individually. However, when these questions were categorized under the same topic, it was shown that mothers with infants in this age range had many questions about baby feeding such as breastfeeding, feeding schedule, and the amount of feeding. Mothers with 2–3-month-old infants most frequently asked questions regarding sleep (T3, 18.1 %), followed by excrement (T2, 8.8 %), skin troubles (T7, 8.2 %), the volume of feeding and growth (T4, 7.9 %), and feeding schedule (T6, 7.8 %). Mothers with 4–6-months-old infants also asked questions regarding sleep (T3, 15.7 %) most frequently, followed by weaning (T9, 13.9 %) and medical problems (T8, 8.1 %). In mothers with 7–12-month-old infants, the most frequently asked questions were regarding

weaning (T9, 18.4 %), followed by solid food (T15, 13.4 %), and the amount of feeding and growth (T4, 9.7 %). Mothers with 13–24-month-old toddlers most frequently asked questions regarding play and learning (T1, 20.1 %), followed by solid food (T15, 16.2 %), book recommendations and child development (T11, 11.8 %), and medical problems (T8, 11.8 %). Lastly, the questions most frequently asked by mothers with 25–36-month-old toddlers were about play and learning (T1, 26.6 %), followed by book recommendations and child development (T11, 16.2 %) and medical problems (T8, 13.7 %).

3.3. Mothers' own expressions of their parenting performance, revealed in keyword network analysis

Of the 11 words revealing the emotions or states of mothers with

infants/toddlers, only five (concern, consider, hard, crazy, exhausted) had a correlation of 0.1 or higher with other words. The words that correlated with each of the five words are shown in Fig. 4. Words that showed a correlation over 0.1 with “hard” were: cry, sleep, ache, breastmilk, time, mom, mind, lie, husband, rearing, and thoughts. The words correlated with “exhausted” were: cry, sleep, and peevish. Sleep, cry, and wake were correlated with “crazy.” Based on the parenting-related questions, it was shown that babies’ crying and not sleeping were the problems driving mothers crazy and making them feel tired and challenged. While mothers were “concerned” about their baby’s weight, the words correlated with “consider” were daycare centers, good, advice, many, send, and thoughts.

4. Discussion

Topic modeling analysis showed that the most common topics were related to feeding, such as breastfeeding, the amount of feeding, and the feeding schedule. The next most common topics were sleep, solid food, play and learning, and medical problems. The findings were consistent with a previous study in which questions posted on two pregnancy/childbirth/parenting websites were analyzed (Farrell, 2018). In that study, questions regarding nutrition, sleep, and health were frequently asked. The current study findings were also in line with Devolin et al. (2013) findings in a study where information and emotional support needs among parents with children under the age of six were examined, and questions concerning breastfeeding, car safety, and sleep problems were asked with high frequency. These findings suggest that parents with infants/toddlers are extremely interested in everyday childcare, such as feeding, putting children to sleep, education, play, and health; thus, they have a significant need for parenting support in these areas.

The frequency of a topic being mentioned varies according to the age of the baby. Mothers with newborns under 1 month of age asked questions regarding breastfeeding most frequently. According to age-specific breastfeeding rates in Korea (Statistics Korea (2019a), 2019a), the exclusive breastfeeding rate at 4 weeks of age was 40.4 %, the partial breastfeeding rate was 48.4 %, and the formula feeding rate was 11.2 %. This is believed to be the result of most mothers are breastfeeding newborn babies under 4 weeks old. In particular, mothers were very interested in ways to increase their breastmilk production. According to the data available at Statistics Korea (Statistics Korea, 2019b), 42.4 % of mothers who stopped breastfeeding said that they stopped because of an insufficient amount of breastmilk. It is believed that mothers choose baby formula over breastmilk when they think they cannot feed their babies enough with breastmilk only. Therefore, adequate information

regarding breastfeeding and relevant support should be provided for mothers with infants aged less than 4 weeks, the age range in which the rate of breastfeeding is the highest.

For mothers with 2–6-month-old infants, questions regarding sleep were most frequent. This aligns with the fact that infants’ circadian rhythm of the day-night cycle has not yet been developed. Until 3 months after birth, sleep patterns are irregular and infants typically wake up in the middle of the night. The sleep structure seen in adults, that is, the day-night cycle, develops 3 months after birth (Koo & Kim, 2013). The keywords under the topic of sleep show that mothers are tired and worn out because their babies often wake up during the night, and it is hard to put them to sleep. This finding was similar to that of a previous study (Ball et al., 2018) which states that the greatest difficulty related to baby sleep problems was frequent waking up at night (58.0 %), and, because of this, parents experienced fatigue/burn-out (44.0 %) and stress/anxiety (29.0 %).

We found that “hard,” “exhausted,” and “crazy” were correlated with “cry” and “sleep.” It was reported that the infant’s sleep problems can affect the parents’ parenting behavior and increase the risks of post-partum depression and family stress (Sadeh et al., 2010). On the other hand, there is a bidirectional relationship between parent and the infant’s sleep patterns, and longitudinal studies have emphasized the importance of parental roles in sleep development in children and demonstrated the effectiveness of sleep intervention involving parents as the agent of change (Tikotzky, 2017). In particular, a single consultation with a professional that focuses on behavioral strategies for improving sleep in toddlers can help improve sleep and increase maternal emotional well-being (Symon & Crichton, 2017). Accordingly, care providers in clinics and communities who meet mothers raising infants/toddlers should identify any parenting difficulties and be able to help them via active intervention.

Questions regarding weaning food were frequent for 4–12-month-old infants. In general, weaning begins around 4–6 months after birth, and baby foods are initiated around the age of 12 months (Schwartz et al., 2011). The current study found that weaning feeding frequently appeared in questions posted by mothers with 4–6-month-old or 7–12-month-old infants which reflects the developmental characteristics in these age ranges. In particular, daily diet schedule and food amount were shared in a significant number of postings, demonstrating that mothers wanted to confirm whether they were giving the correct weaning foods to the baby. In addition, many questions were asked regarding the appropriate ingredients corresponding to each developmental stage and recipes. It was clear that mothers had much interest in nutrition and choice of ingredients while considering the baby’s

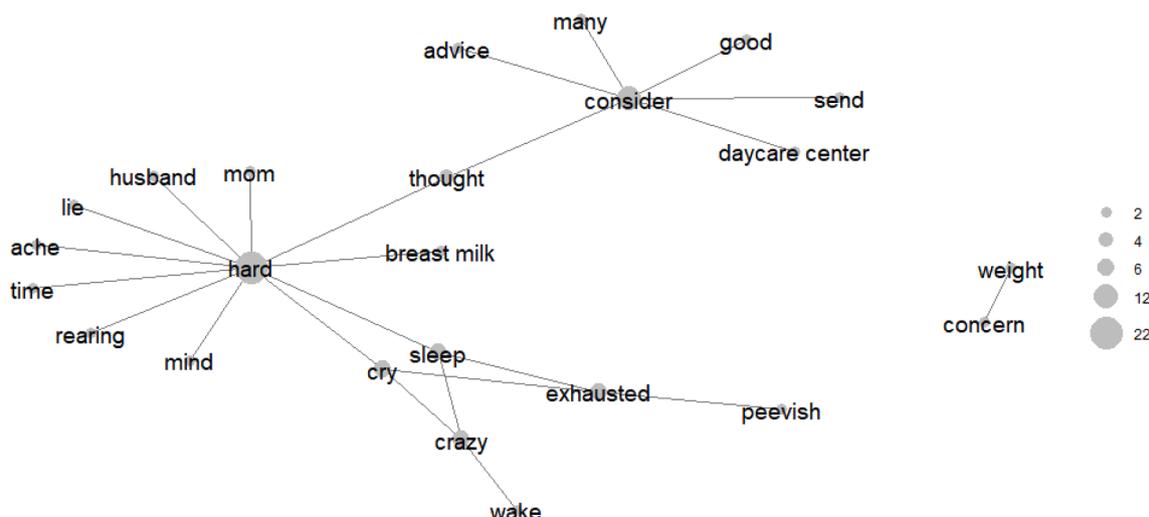


Fig. 4. Keyword analysis related to infants’ mothers’ thinking or emotional words.

developmental characteristics by phase. This aligns with a previous study (Kim et al., 2019) that found that mothers prioritized food safety, nutrition, and diversity of ingredients as important factors in weaning. As found in this study, mothers needed support regarding how to prepare baby food at different developmental stages and what to do when the baby did not eat enough. It was also reported in a previous study (Kim et al., 2019) that 68.1 % of mothers responded that they needed special education on weaning food.

For 13–24-month-old and 25–36-month-old toddlers, there were many questions regarding play and learning, book recommendations, and child development. For play and learning, mothers with toddlers had questions about when they should send their children to daycare centers and how they should choose a daycare center, reflecting the characteristics of this age range in which children are sent to daycare centers rather than being cared for at home all day. Mothers also asked about the ways in which they could play with their toddlers. These findings are consistent with a previous study finding where parents wanted information and consultations on the appropriate play and learning for the baby's age (Kim, 2002).

Parenting difficulties experienced by mothers differed according to the developmental phase of the baby. Therefore, appropriate parenting support should be provided by considering the baby's developmental phase and parental characteristics. From birth to six months, parenting education should be related to feeding and sleep. From seven to 12 months, education should focus on baby foods, and from 13 to 36 months, it should be regarding baby play and learning, book recommendations, and child development. Parenting education should focus on educational topics appropriate for the baby's age and relevant approaches should be investigated from various perspectives. For example, in the case of sleep, guiding an understanding of normal sleep patterns in toddlers can help support stress-free parenting (Ball et al., 2018). Hence, sleep educational interventions using such an approach are necessary. Here, care providers for infants/toddlers and mothers should be able to understand the condition, signals, and behavior of each baby and provide the mother with information through role modeling (White et al., 2002).

The researchers of this study chose to conduct research by selecting a representative pregnancy/childbirth/parenting community in Korea. Since the one chosen was a nationally representative community and the number of questions posted was enormous, data collection was limited to a single month, from October 1 through 30, 2019. Hence, it is likely that the data reflected temporal/seasonal features. Additionally, since the question postings were anonymous, it was not possible to examine question contents in terms of demographic characteristics. Additionally, as only postings specifying the baby's age up to 36 months were selected in the study, questions about age range were excluded from analysis because the baby's age was not stated. Nevertheless, this study is significant in that parenting informational needs corresponding to the baby's age were confirmed based on the questions phrased in the language of mothers, and the areas where mothers felt particularly challenged to provide everyday childcare were identified using related-keyword analysis.

5. Conclusion

In this study, 15 topics pertaining to parenting informational needs were identified using a text mining technique to explore the contents and phrases in parenting-related question posts by mothers with infants/toddlers in a representative online pregnancy/childbirth/parenting community in Korea. We found that the most common topics were feeding/eating and sleep issues. In addition, it was demonstrated that mothers had different parenting informational needs depending on the babies' ages in months. The younger the baby was, the higher was the need for information from mothers. Keyword network analysis showed that mothers had difficulty putting their babies to sleep and stopping them from crying.

Based on the study findings, the following conclusions are drawn. Care providers in clinics and communities should be aware that concerns about feeding/eating and sleep are common among mothers of young children, identify any parenting difficulties, and be able to help them via active intervention. Using existing and well-established social networks as a program venue is beneficial to providing reliable and evidence-informed information to parents. Parents may encounter misinformation in online parenting communities. Therefore, future studies must research whether parenting questions are appropriately answered through comments analysis.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to thank JH Shon, MJ Kim, and SM Ha for their contribution to data cleaning.

Funding

This work was supported by the Dong-A University research grant. Authors' contribution

SH has made contributions to the manuscript preparation, editing, and review. KJ has made contributions to the conception, design, editing, and review. JO has made contributions to the manuscript preparation, analysis and interpretation of data, manuscript editing, and review. All authors read and approved the final manuscript

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chilgyouth.2022.106768>.

References

- Ahn, S., Lee, K., Lee, J., & Kim, E. (2020). A semantic network analysis of parenting stress on social media. *Journal of Korean Home Management Association*, 38(1), 61–77. <https://doi.org/10.7466/JKMA.2020.38.1.61>
- Back, Y. M. (2017). *Text-mining using R. 1st ed.* Hanulplus.
- Ball, H. L., Douglas, P. S., Kulasinghe, K., Whittingham, K., & Hill, P. (2018). The possums infant sleep program: Parents' perspectives on a novel parent-infant sleep intervention in Australia. *Sleep Health*, 4(6), 519–526. <https://doi.org/10.1016/j.sleh.2018.08.007>
- Barlow, J., Smailagic, N., Ferriter, M., Bennett, C., & Jones, H. (2010). Group-based parent-training programmes for improving emotional and behavioural adjustment in children from birth to three years old. *Cochrane Database of Systematic Reviews*, 3. <https://doi.org/10.1002/14651858.CD003680.pub2>
- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent Dirichlet allocation. *The Journal of Machine Learning Research*, 3, 993–1022.
- Devolin, M., Phelps, D., Duhaney, T., Benzie, K., Hildebrandt, C., Rikhy, S., & Churchill, J. (2013). Information and support needs among parents of young children in a region of Canada: A cross-sectional survey. *Public Health Nursing*, 30(3), 193–201. <https://doi.org/10.1111/phn.12002>
- Farrell, A. (2018). Accuracy of online discussion forums on common childhood ailments. *Journal of the Medical Library Association: JMLA*, 106(4), 455. <https://doi.org/10.5195/jmla.2018.355>
- Kim, J. H., Kwak, S. J., & Jeon, Y. Y. (2017). Exploring contexts and meanings of mothers' on-line child rearing participation. *Early Childhood Education Research and Review*, 21(2), 509–539.
- Lebron, C. N., St. George, S. M., Eckembrecher, D. G., & Alvarez, L. M. (2020). Am I doing this wrong? Breastfeeding mothers' use of an online forum. *Maternal & Child Nutrition* 16(1), e12890. <https://doi.org/10.1111/mcn.12890>.
- Koo, D. L., & Kim, J. (2013). The physiology of normal sleep. *Hanyang Medical Review*, 33, 190–196.
- Kim, Y., Lee, J., & Yoon, E. (2019). Comparison of the perceived importance and performance of considering factors when providing weaning foods. *Journal of the Korean Society of Food Science and Nutrition*, 48(3), 362–371. <https://doi.org/10.3746/jkn.2019.48.3.362>
- Kim, J. S. (2002). The study on the mother's needs for information of the child care web sites. *Korean Parent-Child Health Journal*, 5(1), 38–49.
- Mercer, R. T. (2004). Becoming a mother versus maternal role attainment. *Journal of Nursing Scholarship*, 36(3), 226–232. <https://doi.org/10.1111/j.1547-5069.2004.04042.x>

- Min, J. W., Kwon, M. K., Yoon, J. Y. (2014). *An analysis on parents' using child caring information and measures to increase the availability* (pp. 77–117) Seoul (Korea): Institute of Child Care and Education.
- Moon, R. Y., Mathews, A., Oden, R., & Carlin, R. (2019). Mothers' perceptions of the Internet and social media as sources of parenting and health information: Qualitative study. *Journal of Medical Internet Research*, 21(7), e14289.
- National Institute of Korean Language. (2022). *Korean Dictionary*. Seoul: National Institute of Korean Language https://opendict.korean.go.kr/search/searchResult?focus_name_top=query&query=%EB%8F%85%EB%B0%95%EC%9C%A1%EC%95%84.
- Porter, N., & Ispa, J. M. (2013). Mothers' online message board questions about parenting infants and toddlers. *Journal of Advanced Nursing*, 69(3), 559–568. <https://doi.org/10.1111/j.1365-2648.2012.06030.x>
- Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Medicine Reviews*, 14(2), 89–96. <https://doi.org/10.1016/j.smrv.2009.05.003>
- Schwartz, C., Scholtens, P. A., Lalanne, A., Weenen, H., & Nicklaus, S. (2011). Development of healthy eating habits early in life. Review of recent evidence and selected guidelines. *Appetite*, 57, 796–807. <https://doi.org/10.1016/j.appet.2011.05.316>
- Silge, J., & Robinson, D. (2017). *Text mining with R: A tidy approach*. O'Reilly Media Inc.
- Statistics Korea (2019a). Feeding pattern by age of married women (15–49 years old). Daejeon: Statistics Korea. <https://kosis.kr/statHtml/statHtml.do?orgId=331&tblId=DT_33101N411&vw_cd=MT_ZTITLE&list_id=331_33101_03_04&seqNo=&lang_mode=ko&language=kor&obj_var_id=&itm_id=&conn_path=MT_ZTITLE>.
- Statistics Korea. (2019b). *When and why to stop breastfeeding 2017*. Daejeon: Statistics Korea. http://kosis.kr/statHtml/statHtml.do?orgId=117&tblId=DT_117101_043&vw_cd=MT_OTITLE&list_id=117_001_003&scrId=&seqNo=&lang_mode=ko&obj_var_id=&itm_id=&conn_path=E1.
- Statistics Korea. (2021a). *Primary caregiver of young children 2020*. Daejeon: Statistics Korea. https://kosis.kr/statHtml/statHtml.do?orgId=154&tblId=DT_154001_077&conn_path=I2.
- Statistics Korea. (2021b). *Total fertility rates 2020*. Daejeon: Statistics Korea. https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A21&conn_path=I2.
- Symon, B., & Crichton, G. E. (2017). The joy of parenting: Infant sleep intervention to improve maternal emotional well-being and infant sleep. *Singapore Medical Journal*, 58(1), 50. <https://doi.org/10.11622/smedj.2016046>
- Tikotzky, L. (2017). Parenting and sleep in early childhood. *Current Opinion in Psychology*, 15, 118–124. <https://doi.org/10.1016/j.copsyc.2017.02.016>
- White, C., Simon, M., & Bryan, A. (2002). Using evidence to educate birthing center nursing staff: About infant states, cues, and behaviors. *MCN: The American Journal of Maternal/Child Nursing*, 27(5), 294–298.
- Yamada, R., Rasmussen, K. M., & Felice, J. P. (2019). “What is ‘enough’, and how do I make it?”: A qualitative examination of questions mothers ask on social media about pumping and providing an adequate amount of milk for their infants. *Breastfeeding Medicine*, 14(1), 17–21. <https://doi.org/10.1089/bfm.2018.0154>
- Yoon, Y. M. (2019). *Introduction to media content analysis*. Communicationbooks.