

Analysis of Infertility Keywords in the Largest Domestic Mom Cafe Bulletin Board in Korea Using Text Mining[☆]

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ABSTRACT

The purpose of this study is to examine consumers' perceptions of domestic infertility support policies based on infertility-related keywords and the trends of their changes. To this end, Momsholic, a mom cafe which has the most active infertility-related bulletin boards on Naver, was selected as the analysis target, and 'infertility' was selected as a keyword for data search. The data was collected for three months. In addition, network analysis and visualization were performed using R for data collection and analysis, and cross-validation was attempted using the NetDraw function of 'textom 1.0' and the UCINET6 program. As a result of the analysis, the main keywords were cost, artificial insemination, in vitro fertilization, freezing, harvest, ovulation, and how much. Next, looking at the central value of the degree of connection, it was found that the degree of connection between the words cost, cost, how much, problem, public health center, and artificial insemination was high. According to the results of this study, women who visit mom cafes due to infertility in Korea are more interested in the cost. It is believed to be closely related to infertility treatment as well as in vitro fertilization and egg freezing. Therefore, by examining keywords related to infertility, it has academic significance in that it is possible to identify major factors that end users are interested in. Furthermore, it is possible to redefine the guidelines for domestic infertility support policies by presenting infertility support policies that reflect the factors of interest of end consumers.

☞ keyword : Infertility, sterility, infertility policy, infertility stress, infertility quality of life

1. Introduction

Infertility is defined as the absence of a child for 1 year for women under the age of 35 and 6 months for women over the age of 35 in normal marital relationship [1]. According to Statistics Korea, the number of live births in the country in 2019 was the lowest since the statistics have been kept. The total number of births in 2019 was 303,100, a decrease of 23,700, or 7.3%, from the previous year, and the total fertility rate was 0.92, a decrease of 0.06 from the previous 0.98 [2]. In 2018, 12.1% of married women in Korea were experiencing infertility, and the number of women diagnosed with infertility increased from 148,892 in 2006 to 208,703 in 2017, an average annual increase of 3.1% [3]. The overall infertility rate of women of childbearing age in Korea is 13.2%, which is higher than

that of major advanced countries such as the United States (6.7%), the United Kingdom (8.6%), and Germany (8.0%). The number of patients receiving infertility treatment increased by about 43% from about 160,000 in 2007 to about 229,000 in 2018 [4].

In order to solve the problem of infertility and low fertility, a national fertility treatment cost support project started in 2006, and in vitro fertilization and artificial insemination procedures are being actively performed. As a result, the number of infertility procedures is increasing to more than 100,000 every year, and as the technology of infertility treatment develops, the pregnancy success rate is also increasing [5]. In addition, even if the cause of infertility is unknown or the cause is not in the woman, the problem of infertility is regarded only as the woman's responsibility, and all the pain in the infertility treatment process is borne by the woman. In this way, infertility becomes a stress for women by the diagnosis itself, and the treatment process of infertility is a factor that reduces the quality of life due to long time consumption and physiological and economic burdens [6].

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(Table 1) Causes of Infertility Grouped by Gender

Groups		Age	BMI	FSH	AFC	Count	Motility	Morphology
Unexplained	Mean \pm SD	32 \pm 5.8	27.8 \pm 6.4	6.7 \pm 2.7	15.8 \pm 8.9	50 \pm 33.6	53.8 \pm 13.8	5.7 \pm 5.4
	Median	32	26	6.35	14	43*	55*	4*
	25%, 75%	27, 37	23, 32	5.3, 7.9	9, 21	23, 70	45, 65	3
Male infertility	Mean \pm SD	32 \pm 7.2	28 \pm 6.4	6.9 \pm 3.3	14.7 \pm 8.9	33 \pm 27.4	45.8 \pm 15.3	2.8 \pm 1.5
	Median	31.5	27	6.3	13	25	50	3
	25%, 75%	27, 36	24, 32	5.2, 7.8	9, 20	12, 48	33, 60	2, 3
Male & Female infertility	Mean \pm SD	33.8 \pm 6.5	28 \pm 8.7	8.4 \pm 3.9	10 \pm 10.5	38.6 \pm 31.4	49.6 \pm 14	3.9 \pm 2.8
	Median	35*	27	7.5*	6*	30	50	3
	25%, 75%	28, 38	23, 32	5, 11	3, 15	12, 59	41, 60	2, 5
Female infertility	Mean \pm SD	33.5 \pm 6.3	28.3 \pm 6	8 \pm 3.8	13.7 \pm 11.6	68 \pm 34.9	58.7 \pm 11.8	8 \pm 4.2
	Median	34*	27	7*	11*	62*	60*	6*
	25%, 75%	29, 38.5	24, 32	5.8, 9	4, 20	40, 87.8	50, 65.8	5, 10

Overseas, while recognizing infertility as a social problem, providing information and medical support related to various infertility procedures to improve the quality of life of infertile women, self-help groups for infertile women and couples, group counseling, psychosocial infertility-related nursing counseling, etc. While various social support programs are being operated, there are still insufficient studies in Korea to identify the factors that influence social support on the quality of life of infertile women [7]. Also, it is difficult to find a study that investigated infertile women from the perspective of infertile women on what kind of worries they actually have.

Given that infertility is an issue that is closely related to fertility, and hence government population policy, it would be interesting to see if there are any differences in views on infertility and how to deal with it in posts on online communities with a large number of members. An online mom cafe in Korea is a type of online community or forum where mothers or expectant mothers can share their experiences, opinions, and information on various topics related to parenting, pregnancy, childcare, education, health, etc.. Online mom cafes are very popular and influential in Korea, as they provide a platform for social interaction, emotional support, and consumer behavior among mothers.

Therefore, in this study, the infertility keywords of Korea's largest mom cafe, where only women are allowed to join, were analyzed to identify the practical interests of infertile women. Then, through network analysis, the interests of infertile women were compared focusing on

keywords that appear high in connection centrality and mediation centrality. In addition, based on the analysis results and discussions of these studies, directions and implications for the establishment and revision of fertility policies of the government were presented in the future.

2. Literature Review

2.1 Infertility Causes and Tests

The cause of infertility is related to the entire process from the generation of male or female reproductive cells to the fertilization of sperm and egg, the development of the fertilized embryo, and the implantation of the embryo in the uterus [8]. Therefore, if there is an abnormality in any one of these processes, it can lead to infertility.

The cause of infertility can be divided into female factors, male factors, couple bilateral factors, and infertility of unknown cause, that is, when pregnancy does not occur even though there is no special abnormality in the infertility test. Although the ratio of infertility between men and women is not precisely presented, scholars report that most of the men and women are similar, with a female factor of 30%, male 30%, male and female 20%, and unknown cause at 20% [8]. For this reason, modern medicine believes that infertility is not just a woman's problem, but a couple's problem, and diagnosis and treatment are possible only when the couple cooperates [9]. A Table 1 compares some factors that affect fertility for two groups of infertile couples:

unexplained infertility and male infertility. The factors include age, body mass index (BMI), follicle-stimulating hormone (FSH), antral follicle count (AFC), sperm count, motility, and morphology. The Table 1 shows the median values of these factors for each group.

The follicle-stimulating hormone(FSH) level of the female partner in the couple, that is a hormone that stimulates the growth and maturation of eggs in the ovaries. Generally, a low FSH level indicates a good ovarian reserve, while a high FSH level indicates a poor ovarian reserve [10]. The AFC is the antral follicle count of the female partner in the couple, which is a measure of the number of small follicles in the ovaries that can potentially develop into mature eggs. Generally, a high AFC indicates a good ovarian reserve, while a low AFC indicates a poor ovarian reserve [11].

Thus, when examining and diagnosing infertility, it is important to consider the problems of both sides of the couple, and it is important to test both sides because only one of the couple may not be able to conceive. Therefore, it is desirable for infertile patients to visit their spouses when they first meet with a doctor.

2.2 Emotional and Physical Responses to Depression in Infertile Women

In the case of Korean society, traditional stereotypes of gender roles still remain deeply rooted, so even if the cause of infertility lies with men, the pain and conflict that infertile women suffer because they have to conceive is very serious [7]. Infertile women think of all their daily tasks in relation to infertility, and gradually become obsessive clinging to the whole of their lives on pregnancy, a feeling that life has stopped, a sense of atrophy, guilt, a feeling of invisible cripple, anger, impatience, sense of worthlessness and sadness, etc. have emotional experiences. In addition, they have a polarized relationship in which they become close, distant, and uncomfortable in marital relationships and relationships with their in-laws. The phenomenon was said to be conspicuous [12].

There is a report that the degree of depression seen by infertile women corresponds to cancer patients, heart disease patients undergoing rehabilitation, and high blood pressure patients [13]. There is nothing to do, and the stomach is

stuffy, restless, and nervous. In addition, due to a decrease or loss of motivation, people lose interest in things or activities that were previously enjoyable, and they do not enjoy themselves as before, avoid meeting people, do not participate in social activities, become lethargic, and suffer from difficulties in daily activities [14]. Emotionally, infertility can lead to depression, anxiety, and personality abnormalities due to guilt, self-deprecation, and inferiority complex, and the loss of hopes and expectations, relationships, status, self-esteem, self-confidence and stability [15].

2.3 Infertility and Changes in the Government's Population Policy

In Korea, interest in infertility has increased significantly since the 1990s, and this is due to the development of related medical technology, but the rise of the low fertility problem is an important factor [3]. As the fertility rate decreased, infertility received national attention, and infertility was raised as a major cause of low fertility.

In 2003, the government officially began to implement a policy to encourage childbirth. In 2002, the total fertility rate was 1.17, and the low fertility and aging problems worsened, and efforts to respond to these problems began in earnest [4]. In 2005, the fertility support policy was promoted through the Basic Act of Low Fertility and Aging Society, but the fertility rate was further lowered to 1.08. Accordingly, in 2006, the 1st Basic Plan for Aging Society with Low Fertility was announced, called 'Saeromaji Plan 2010', and 'Support for Infertile Couples' was introduced as one of the policies to support the low fertility [4]. The support project for infertile couples was not only implemented according to the government's plan, but also reflected the continuous support needs of infertile women. They made an active effort to submit a petition.

Looking at the perspectives and policies on population policy and infertility according to the population change so far, it can be seen that the government's population policy changes according to the fertility rate, and interest or support for infertility is also different. The government started to support treatment for infertile couples when there was concern about the low birth rate, but it can be inferred that

this rapid change occurred in a relatively short period of time, and the social perspective on infertility may have changed. In addition, as it became clear that the cause of infertility was no longer unique to women due to the development of medical technology, infertility, which was mainly considered a problem for women, became a disease that men, families, and even the government could solve. There is also a growing public opinion that we need to change our abnormal view. Since 2011, for the first time in the 'Infertility Couple Support Project', it is emphasized that infertility is treatable [16]. This study analyzed the keywords for infertility through the bulletin board of the largest mom cafe in Korea to understand how these government policies and views on infertile women have emerged and changed [16].

3. Research Method

3.1 Research Tools and Procedures

In this study, a big data analysis was conducted through the utilization of text mining techniques, and subsequently, semantic network analysis was employed.

3.1.1 Text Mining

Text mining is the process of finding useful information from text data, which is usually unstructured and large-scale. Text mining can also be called text data mining or text analytics. Text mining uses advanced techniques such as machine learning, statistics, linguistics, and natural language processing to analyze and extract patterns and insights from text [17]. Text mining is used to find the similarity and generality of ranking or recognition by refining the collected words using natural language processing and morpheme analysis technology of unstructured text data, extracting words and suggesting the frequency [18]. In other words, the application of text mining holds the potential to illuminate intricate relationships that might elude conventional analysis.

In this study, words irrelevant to leisure activities were deleted among the words extracted from the texts collected related to leisure activities. On the other hand, words with the same meaning were merged, and refining work was

performed, such as integrating when there was an error in spacing or incomplete words were also related. In order to exclude the subjectivity, the refining process involved collaboration with three groups of experts, including professors, researchers, and doctoral students. Their diverse perspectives aided in maintaining fairness and reliability. In summary, the study meticulously selected words, discarding irrelevant ones and grouping synonymous terms. Corrections were made for errors. Collaboration with experts from various fields enhanced the study's credibility and accuracy.

3.1.2 Semantic Network Analysis

Semantic network analysis is a method of analyzing text data based on the relationships between words or concepts. It involves creating a network or a graph where the nodes represent words or concepts and the edges represent the connections or associations between them. Semantic network analysis can help to reveal the main themes, patterns, and structures of a text corpus, as well as the similarities and differences among texts [19]. Since it involves using social network analysis on communication messages, this application is mostly used in the field of social science [20]. This is an analysis method that derives the content of the message contained in the form of the relationship by analyzing the structural relationship of whether the words forming the message are used and placed in the text, and analyzing the pattern and meaning of the structure [21].

Therefore, in this study, the UCINET6 program, utilized for semantic network analysis, was employed to identify the connection structure between words. Network analysis and visualization of words linked to leisure activities were then conducted using the Netdraw function. Additionally, CONCOR analysis was performed to derive clusters of similar words related to leisure activities.

3.1.3 Network Analysis

Among the methods of analyzing the knowledge structure of recent studies, network analysis is emerging. Network analysis is a method of studying the structure and behavior of networks, which are systems of interconnected entities or nodes [22]. Networks can represent various phenomena, such as social relationships, communication patterns, biological

interactions, transportation systems, and more. Network analysis can help to understand the properties and dynamics of networks, such as their size, density, centrality, clustering, connectivity, robustness, and evolution [23].

Such network analysis methods include keyword network analysis, that is to identify the knowledge sharing relationship through keywords under the premise that the keywords presented in a thesis are the key words that best express the topic of the thesis [24]. Keyword network analysis has been studied in various fields such as health care, geography, education, and learning disabilities.

3.1.4 Data Processing Method

In this study, keywords were extracted using the R program from atypical texts displayed on the bulletin board of Momsholic, which is the Naver’s Mom Cafe, and the importance was identified through the frequency of keywords. Text mining analysis was then used to find detailed keywords of leisure activities.

Therefore, this study calculates the centrality of the degree of connection and the density of the entire network using R programming for the derived top 50 key words, and grasps the relational structure of the key words related to leisure activities according to the social network perspective, and the frequency of occurrence at the same time. was identified as related.

In order to see the network between words related to leisure activities, network analysis and visualization were performed using R programming, and the relationship between keywords was identified by conducting CONCOR analysis.

4. Results

4.1 Data Collection

Over a three-month timeframe, we collected a total of 2,563 texts from the mom cafe ‘Momsholic’ provided by Naver, focusing on infertility-related keywords. This resulted in a total word frequency of 218.

4.2 Data Analysis

4.2.1 Infertility Keyword Analysis

Due to limitations in network visualization expression, text mining and UCINET6 program were conducted to analyze the keywords for leisure activities centered on the top 50 keywords.

Connection degree centrality is an index indicating whether words are centered in a network, and it can be interpreted that the higher the value of connection degree centrality, the higher the influence in the network [25].

Network centrality refers to the centralization tendency of the entire network, and the results of the study were 4.411%, mean = 0.981, standard deviation = 1.191, maximum value = 5.303, and minimum value = 0.121. Additionally, the density, which is a concept representing the degree of relationship among all nodes in the network, can be interpreted as being very high as it approaches or increases to a value of about 0.5 within the range of 0 and 1 [26]. Accordingly, the network density of this study was 0.843, indicating that the degree of relationship among all nodes in the network is very high.

4.2.2 Infertility Network Analysis

In order to visually derive the connection relationship within the network, a network graph was performed using the R program. Figure 1 shows the network visualization results based on the centrality of the degree of connection in order to derive patterns and connection relationships within the network as a starting point.



(Figure 1) Infertility Network Analysis

4.2.2 Infertility Word Cloud

Figure 2 shows the word cloud of the keyword ‘infertility’. As a result of word cloud visualization, the frequency of fertility treatment, pregnancy, and DNA damage was high, and the result is shown below.



(Figure 2) Infertility Word Cloud

5. Conclusion

This study aimed to provide an insightful overview of the patterns and trends related to infertility by conducting a comprehensive keyword analysis of discussions on Naver’s Mom Cafe. By delving into the most prominent keywords associated with infertility, researchers uncovered a multifaceted landscape shaped by the concerns and inquiries of individuals facing fertility challenges.

Through meticulous keyword analysis, it became apparent that there is a notable emphasis on seeking information about infertility programs and support options. These inquiries often revolved around factors such as cost considerations and essential blood tests, indicating that financial aspects and medical assessments are pivotal factors in the infertility journey. Moreover, the findings highlighted a strong interest among infertile women in comprehending the costs linked to various fertility interventions, including artificial insemination, in vitro fertilization (IVF), and other related procedures. Intriguingly, discussions also revealed a curiosity about products tied to egg collection and freezing, suggesting a growing awareness of alternative options for addressing fertility concerns.

Based on the insights gleaned from active participants of Momsholic Cafe, it can be inferred that the internet continues to serve as a valuable platform for sourcing information about infertility. This trend is likely to persist in

the future, driven by the need for accessible and up-to-date knowledge in this domain. Given the observed trends, it is reasonable to predict that the search for resources related to infertility treatments, along with the sharing of personal experiences and success stories, will remain ongoing, aligning with the current government-supported initiatives.

Looking ahead, the prospect of future research incorporating big data analysis holds immense potential. By focusing on specific types of infertility, researchers can not only gauge the general interests of individuals grappling with fertility challenges but also gain a deeper understanding of the nuanced strategies and actions undertaken to navigate intricate infertility treatments. This could lead to more tailored approaches to support, treatment, and awareness campaigns that cater to the distinct needs of various segments within the infertility community.

The study collected a substantial dataset comprising 2,563 texts from Momsholic, a Naver mom cafe dedicated to leisure activities, spanning the period of three months. This dataset allowed researchers to meticulously analyze the discourse surrounding infertility within the community. The resulting analysis encompassed a total of 218 unique word frequencies, underscoring the richness and diversity of discussions related to infertility within this online forum.

5.1 Limitations and Future Study

This study undertook a comprehensive analysis of infertility-related keywords extracted from the Naver Mom Cafe bulletin board, approaching the topic from a network perspective. However, it’s important to acknowledge several inherent limitations that impact the scope and generalizability of the findings.

One notable limitation is related to the data collection process. This study focused solely on keywords posted within the Naver’s Mom Cafe community, omitting potential insights from external sources such as newspaper articles or academic journals. Consequently, this restricted data collection approach might limit the ability to draw broad conclusions about broader concerns and perspectives related to infertility. The enormity of available medical data on infertility, both within domestic and international contexts, necessitates significant investments of time and resources for

comprehensive collection and analysis.

Another constraint involves the approach to identifying trends within female infertility based on network density, component analysis, and centrality. While these network-oriented methodologies provide valuable insights, they inherently come with their own limitations. They might not capture the entire spectrum of factors contributing to trends and interests in female infertility, potentially leaving out crucial nuances.

Additionally, the study's efforts to standardize keywords, although commendable, faced challenges. The variations in how similar concepts were expressed necessitated expert input for normalization. However, this process might not have fully accounted for the underlying content and context variations, which could potentially impact the accuracy of the standardization.

In light of these limitations, the study proposes valuable directions for future research. A follow-up study could address these challenges and refine the methodologies employed, potentially expanding the data collection to encompass a broader range of sources. Incorporating insights from both academic literature and public discourse could offer a more comprehensive understanding of infertility concerns. Furthermore, employing more sophisticated natural language processing techniques might enhance the accuracy of standardization and uncover more subtle nuances in the data.

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