Aesthetic Plastic Surgery Issues During the COVID-19 Period Using Topic Modeling

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Abstract—**This study investigates media coverage of cosmetic surgery in South Korea from 2014 to 2023 using text mining techniques applied to news articles from BigKinds. It focuses on assessing the prevalence of objective information and the societal impacts of capital-driven misinformation. The research methodology involved optimal topic modeling through perplexity, likelihood, BIC, and similarity measures, identifying five themes within the cosmetic surgery news corpus. Further analysis included quantitative topic recognition via fuzzy clustering by period, sentiment analysis, and network analysis utilizing n-gram techniques to explore relationships between key terms. Findings reveal five main topics covered in cosmetic surgery news: Consumer Psychology, Cosmetic Surgery Market, Cosmetic Companies and Technologies, Side Effects and Incidents, and the Tourism Industry. The period from 2014 to 2016 saw significant coverage, particularly on medical tourism and surgical side effects, while in 2017, attention shifted to the surgical process and market stability. From 2018 onward, news coverage expanded, especially in May, focusing on cosmetic technology and related industries amid increased outdoor activities. With the COVID-19 pandemic in 2020, there was a resurgence in coverage of the cosmetic surgery market. In 2023, post-pandemic, there was an uptick in articles related to cosmetic surgery technology industries and support funds. The core words in cosmetic surgery news were spreading around "plastic surgery," "China," and "Botulinum". The study sheds light on the potential influence of capital on media portrayals of cosmetic surgery and the resulting societal consequences of misinformation.**

Keywords— **Cosmetic surgery; text mining; topic modeling; sentiment analysis; Covid-19**

I. INTRODUCTION

Until the early 20th century, plastic surgery was primarily used to restore bodies damaged by war or accidents. However, in recent years, with the proliferation of the beauty industry and advancements in media and medical technology, the focus of plastic surgery has gradually shifted from reconstruction to encompassing aesthetic enhancement [1], [2]—such a shift aids in increasing individual satisfaction and improving self-image from an aesthetic standpoint. During the recent COVID-19 period, masks provided relative privacy during the recovery phase of facial surgeries. This led to a subsequent emphasis on cosmetic procedures focused on the upper face, which remains visible despite masking [3]–[5].

Previous studies that addressed both COVID-19 and cosmetic surgery mainly focused on medical tourism [6], the resumption of safe cosmetic procedures [7], and public interest in cosmetic surgery using Google Trends or Twitter data [4], [5], [8], [9]. Today's news media significantly influences individuals' attitudes, cognition, and behavior [10], with newspapers being one of the most widely used media for public discourse [11]. Through news analysis, societal meanings are formed, and processes like priming and framing can be understood [12]. Therefore, news articles related to cosmetic surgery are likely to influence people's values, beliefs, attitudes, behaviors, and public opinion formation regarding cosmetic surgery. Moreover, the societal environment has fundamentally changed before and after the global spread of COVID-19, which likely affected societal perceptions and attitudes toward cosmetic surgery. Thus, analyzing relevant news articles is necessary to study the issues and trends in cosmetic surgery.

Recent research in the field of cosmetic surgery utilizing text mining has analyzed considerations for cosmetic surgery [13], YouTube content [14], public interest [9], emotions [10], [11], and satisfaction [17]. This study aims to analyze news articles related to cosmetic surgery in Korea, focusing on the

stages of COVID-19. By examining the topics of news related to cosmetic surgery before and after the COVID-19 outbreak and comprehensively reviewing how they were thematized by year, the social perception changes regarding cosmetic surgery due to COVID-19 are expected to be explored. This will allow for a critical view of the perception of cosmetic surgery formed by the media.

II. MATERIALS AND METHOD

A. Data Collection

The data was collected by searching for 'cosmetic surgery' on BigKinds, a news big data analysis service operated by the Korea Press Foundation. The analysis covered 10 years, from January 1, 2014, to December 31, 2023, and 8,255 news articles were included. Duplicate news articles were excluded, and text analysis was performed based on the frequency of keywords mentioned in the news.

B. Topic Modeling

Topic modeling is an analytical method used to explore hidden themes in vast amounts of text data, with Latent Dirichlet Allocation (LDA) analysis being the most commonly utilized. In LDA, the model predicts which topics specific documents are addressing and calculates the probability of the occurrence of words in the documents as topics, extracting them as topic keywords [18]–[23]. In this study, we determined that LDA is suitable for understanding societal awareness trends by analyzing common topic keywords in news articles related to cosmetic surgery.

C. Semantic Network Analysis

Language network semantic analysis is a methodology that employs network analysis on texts to understand their semantic structure. Paranyushkin [24] introduced a method of representing texts as networks. According to this methodology, text network analysis involves classifying text data to name the most influential concepts and identifying closely related concept groups, enabling comparison and analysis across diverse texts. The N-gram algorithm creates a window of n-sized strings and records the frequency of occurrence of sequences as it moves from left to right through the text. Here, n indicates the size of the string to be extracted, where a value of 1 represents a unigram, 2 represents a bigram, and 3 represents a trigram. In this study, we analyzed the network between keywords using bigrams based on the weight order of keywords.

III. RESULTS AND DISCUSSION

A. News Articles Trends

Table 1 shows the exposure ratio of news articles collected from BigKinds, categorized by year and month. Upon examining the data by year, it is evident that the coverage of cosmetic surgery news tends to decrease over time. This trend can be attributed to people's growing concerns about health and safety, leading them to prefer non-surgical methods such as fillers, Botox, and laser treatments [25], [26]. However, there has been an increase in interest in cosmetic surgery following an increase in face-to-face activities after the COVID-19 pandemic. Analyzing the frequency of cosmetic surgery interest by month reveals that from 2014 to 2017, cosmetic surgery was frequently mentioned in December, presumably due to the upcoming holiday season. However, from 2019 onwards, May emerged as the month with the highest number of mentions. May, in the spring season with warmer weather, prompts people to spend more time outdoors, leading to heightened interest in appearance improvement through cosmetic procedures before the summer vacation season.

TABLE I
NUMBER OF NEWS ARTICLES BY YEAR AND MONTH

Month	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	102	98	94	86	53	38	47	52	57	66
2	91	115	79	78	64	57	29	33	33	69
3	103	91	122	130	73	59	15	27	22	56
4	102	114	89	90	83	61	32	48	33	41
5	68	113	79	82	78	91	51	66	41	59
6	74	78	63	64	61	46	69	47	36	79
7	85	97	51	42	61	46	52	48	68	38
8	78	109	89	263	45	26	24	40	34	70
9	90	106	79	56	51	44	24	38	40	56
10	102	67	79	65	44	56	51	36	42	76
11	99	80	155	73	46	47	37	31	48	66
12	134	146	209	118	74	54	48	48	42	55

The frequency of keywords in cosmetic surgery news is presented in Table 2. The "word" column lists the keywords extracted from each news article, "n" indicates the number of news articles where the word is mentioned, and "ratio" represents the proportion of news articles mentioning the keyword out of a total of 8,255 news articles. The major words are listed in the following order: Plastic Surgery, China, Botulinum toxin, South Korea, Filler, United States, Seoul, and Side effect. China and the United States are globally renowned for medical tourism. South Korea, particularly renowned in the field of plastic surgery, received significant coverage related to the country and location. Moreover, there were frequent mentions of Botulinum toxin and Filler, which are known for their safety and effectiveness in wrinkle improvement. Fig. 1 displays the word cloud generated from words mentioned more than 80 times.

No.	Word	N	Ratio (%)
1	Plastic surgery	1837	22.3
2	China	1540	18.7
3	Botulinum toxic	1529	18.5
4	South Korea	1240	15
5	Filler	1207	14.6
6	United States	1074	13
7	Seoul	910	11
8	Side effect	876	10.6
9	Medication	797	9.7
10	Foreigner	774	9.4
11	Cosmetic Surgery	760	9.2
12	Specialist	739	9
13	Medical staff	627	7.6
14	Dermatology	579	7
15	Cosmetics	573	6.9
16	Health insurance	568	6.9
17	Medical expenses	517	6.3
18	Consumer	512	6.2
19	Aesthetics	482	5.8
20	Tourist	475	5.8

Fig. 1 Word cloud of keywords in cosmetic surgery news over the past 10 years

B. Topic Modeling

Topic modeling was performed to identify the main topics of cosmetic surgery news. To determine the optimal number of topics, the topic number was varied from 2 to 15, considering perplexity, likelihood, Bayesian information criterion, and inter-topic similarity [27]–[30]. The optimal number of topics was determined to be 5.

The main keywords and topics comprising the topic are listed in Table 3. Consumer behavior highlighted in the news is exerting a significant influence on trends in the cosmetic surgery industry. The news reports an increasing interest in cosmetic companies and technologies alongside the growth of the cosmetic surgery market. This heightened interest reflects consumers' desire to seek improved appearance through cosmetic enhancement procedures. However, incidents and side effects related to cosmetic surgery also frequently occur, leading to articles addressing this topic. Finally, the topic of medical tourism for advanced cosmetic surgery in Korea has been chosen. Delving into each topic reveals the following details.

TABLE III
THE TOP 10 KEYWORDS RELATED TO COSMETIC SURGERY

Id	Ratio	Topic name	The top 10 relevant words
1	15.2%	Consumer Psychology	Cosmetic surgery, Consumer, Surgery, Beauty, Procedure, Possibility, Cosmetic procedure, Healthcare, Hospital, Hospital director
2	22.0%	Cosmetic surgery market	Seoul, Health insurance, Medical expenses, Treatment costs, Non-reimbursable, Gangnam, Ministry of Welfare, Insurance premiums, Medical law, Committee
3	22.4%	Cosmetic Companies and Technologies	Botulinum toxin, Filler, United States, Medication, Europe, Meditoxin, Hyaluronic acid, Pharmaceutical Company, Pharmaceutical, Asia
4	19.4%	Side effects and incidents	Plastic surgery, Side effects, Specialists, Medical staff, People, Patients, Online, Double eyelid, Cosmetic surgery, Prosthesis
5	21.0%	Tourism Industry	China, South Korea, Foreigner, Officials, Dermatology, Cosmetics, Tourists, Japan, Chinese, Medical tourism

The following are the interpretations of the 5 topics on cosmetic surgery. Topic 1 encompassed news articles focusing on cosmetic surgery, consumer behavior, healthcare, and hospitals. These articles revealed that when consumers consider cosmetic procedures to improve their appearance, they evaluate the surgical procedure and potential outcomes, as well as the hospital and director. Therefore, the topic was named "Consumer Psychology." Topic 2 was called "Cosmetic Surgery Market" because many news articles dealt with the financial aspects and trends of the cosmetic surgery market, mainly in Seoul, the capital of South Korea.

Articles covered health insurance coverage, healthcare costs, and regulations by medical laws or boards, highlighting the evolving dynamics affecting the Korean cosmetic surgery market structure. In Topic 3, news articles about technological

developments in cosmetics companies, pharmaceuticals, and cosmetic surgery were categorized as "Cosmetic Companies and Technologies." Looking at frequent keywords such as botulinum toxin, filler, and pharmaceutical companies, there was an emphasis on technological innovation led by cosmetic treatment companies, and the global influence of these developments was reflected. Topic 4, "Side Effects and Incidents," focused on news about side effects and accidents from various cosmetic surgeries, ranging from common surgeries such as double eyelid surgery to more complex prosthesis surgeries.

The roles of experts and medical staff, online information search, and patients' experiences were emphasized. Topic 5 was "Tourism Industry," which focused on news about Korea's medical tourism industry. It was confirmed that the demand for dermatology and cosmetics-related services, including surgery, from foreign tourists from neighboring countries such as China and Japan is increasing. Government authorities and medical organizations were watching this trend and working to improve policies and regulations to develop Korea's medical tourism industry.

The number of topics by year is presented in Table 4. Through fuzzy clustering analysis, the topics were divided into four periods (Table 5). Period 1, spanning from 2014 to 2016, saw a lot of news regarding accidents related to cosmetic surgery and medical tourism. Period 2, in 2017, witnessed an increase in promotions educating consumers about the cosmetic surgery market and methods. Period 3, from 2018 to 2019, emphasized cosmetic surgery techniques and companies. Period 4, in 2020, saw an increase in news coverage about support for cosmetic surgery due to the COVID-19 pandemic. In 2023, during the post-COVID era, topics are regressing to those similar to 2018-2019, reflecting increased demand for cosmetic surgery support among consumers during the non-face-to-face period of the pandemic.

TABLE IV
THE NUMBER OF NEWS ARTICLES ABOUT EACH TOPIC BY YEAR

Year	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
2014	113	119	78	398	285
2015	192	221	192	394	332
2016	288	198	197	239	382
2017	328	378	167	188	170
2018	94	146	254	135	157
2019	71	118	234	86	169
2020	47	121	214	69	65
2021	96	142	203	58	73
2022	44	233	136	58	67
2023	52	243	280	68	132

The COVID-19 pandemic has significantly impacted the cosmetic surgery industry [31]-[34]. According to Lem et al. [35], due to the COVID-19 pandemic and the resulting cancellation of elective surgeries, the total number of plastic surgery procedures worldwide decreased by 1.8% in 2020 compared to 2019, with surgical procedures experiencing a more significant decrease of 10.9%. As vaccine distribution progresses and COVID-19 cases decline, the demand for

plastic surgery is rebounding, with patients returning to hospitals for these procedures.

TABLE V
THE RESULT OF FUZZY CLUSTERING ANALYSIS

Year	Cluster 1	Cluster 2	Cluster 3	Cluster 4
2014	0.07	0.09	0.76	0.07
2015	0.02	0.03	0.92	0.03
2016	0.10	0.15	0.50	0.24
2017	0.00	0.00	0.00	0.99
2018	0.06	0.92	0.01	0.01
2019	0.12	0.85	0.01	0.01
2020	0.80	0.17	0.01	0.01
2021	0.87	0.12	0.01	0.01
2022	0.71	0.20	0.03	0.05
2023	0.40	0.51	0.04	0.05

Through sentiment analysis using the Korean sentimental dictionary, it is observed that news articles related to "Cosmetic Companies and Technologies" and "Cosmetic Tourism" tend to be neutral (Fig. 2). However, in topics such as "Side effects and incidents" and "Consumer Psychology," there is a higher frequency of negative words. For instance, cosmetic surgeries, like any surgical procedure, carry inherent risks such as infection, scarring, and adverse reactions to anesthesia. When patients experience these risks, it often leads to negative news coverage. If patients are dissatisfied with their results or experience post-surgery complications, they may publicly share these negative experiences, contributing to negative news reports. This finding underscores the importance of addressing patient satisfaction and mitigating risks in the cosmetic surgery industry to maintain a positive public perception.
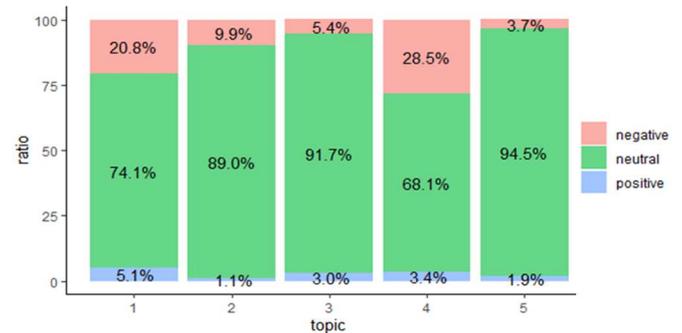

Fig. 2 The sentiment analysis results of topic themes

C. Topic Modeling

Using n-grams, the relationships between words mentioned in news media are depicted as a network in Fig. 3. Words such as "Plastic surgery," "China," and "Botulinum" are central and spreading. The topic "Cosmetic Companies and Technologies" and the topic "Tourism Industry" are connected through the company Hugel. Additionally, the topic "Side effects and incidents" is linked to "filler" and the topic "Tourism Industry." In the topic "Cosmetic surgery market," "Health insurance" is connected to "medical expenses," "insurance cost," and "non-insurance," while "plastic surgery" is associated with "cosmetics" and "surgery."
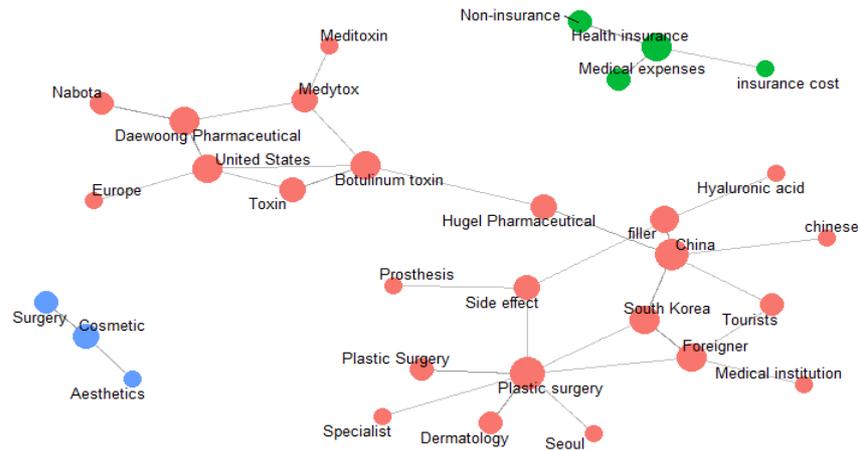
Fig. 3 The network diagram for news-related words in cosmetic surgery based on bigram (weighted by word importance)

IV. CONCLUSION

This study aimed to analyze news articles on cosmetic surgery over the past decade to understand cultural and social perception changes in Korean society and comprehend the media's diverse approaches to cosmetic surgery. The news topics on cosmetic surgery are broadly categorized into five themes: Consumer Psychology, the Cosmetic surgery market, Cosmetic Companies and Technologies, Side effects and incidents, and Tourism Industry. Examining the changes over the years through fuzzy clustering analysis reveals that COVID-19 has influenced the interest in cosmetic surgery, shifting the focus towards cosmetic surgery techniques and companies. However, in the post-COVID-19 era, there has been a return to the expansion of medical tourism and the cosmetic surgery market, indicating that news articles are being generated in response to consumer demand.

This study only collects news articles about cosmetic surgery in South Korea, which may not cover the overall content of cosmetic surgery comprehensively. News articles provide a vast amount of information, and text mining helps quantitatively identify new topics or trends in cosmetic surgery that people might overlook. However, issues such as privacy breaches or exposure of personal information may arise, and efforts such as verifying the accuracy of news information and considering context are necessary to obtain accurate and objective analytical results.

In the future, it is crucial to expand the scope of analysis to include international news articles, social media, and expert interviews. Qualitative research methods should be employed to gather opinions from various stakeholders regarding cosmetic surgery, and discussions should be deepened on ethical issues such as the societal impact, safety, and inequality associated with cosmetic surgery. Additionally, further research is needed to examine whether the media covers the diversity of cosmetic surgery from both promotional and critical perspectives.

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REFERENCES

[1] P. J. Sykes, "The Origins and Personalities of Facial Cosmetic Surgery," Annals of Plastic Surgery, vol. 65, no. 2, pp. 118–122, Aug. 2010, doi: 10.1097/sap.0b013e3181c2a7fc.

[2] C. Meller and S. Choroomi, "The history of facial plastic surgeons," Australian Journal of Otolaryngology, vol. 7, pp. 0–0, Jan. 2024, doi:10.21037/ajo-23-58.

[3] R. T. Cristel, D. Demesh, and S. H. Dayan, "Video Conferencing Impact on Facial Appearance: Looking Beyond the COVID-19 Pandemic," Facial Plastic Surgery & Aesthetic Medicine, vol. 22, no. 4, pp. 238–239, Aug. 2020, doi: 10.1089/fpsam.2020.0279.

[4] A. K. Dhanda, E. Leverant, K. Leshchuk, and B. Paskhover, "A Google Trends Analysis of Facial Plastic Surgery Interest During the COVID-19 Pandemic," Aesthetic Plastic Surgery, vol. 44, no. 4, pp. 1378–1380, Aug. 2020, doi: 10.1007/s00266-020-01903-y.

[5] M. Eggerstedt, M. J. Urban, R. M. Smith, and P. C. Revenaugh, "Interest in Facial Cosmetic Surgery in the Time of COVID-19: A Google Trends Analysis," Facial Plastic Surgery & Aesthetic Medicine, vol. 23, no. 5, pp. 397–398, Oct. 2021, doi:10.1089/fpsam.2020.0605.

[6] P. Varma, J. Kiely, and A. V. Giblin, "Cosmetic tourism during the COVID-19 pandemic: Dealing with the aftermath," Journal of Plastic, Reconstructive & Aesthetic Surgery, vol. 75, no. 1, pp. 506–508, Jan. 2022, doi: 10.1016/j.bjps.2021.11.013.

[7] S. N. Unadkat et al., "Recovery of Elective Facial Plastic Surgery in the Post-Coronavirus Disease 2019 Era: Recommendations from the European Academy of Facial Plastic Surgery Task Force," Facial Plastic Surgery & Aesthetic Medicine, vol. 22, no. 4, pp. 233–237, Aug. 2020, doi: 10.1089/fpsam.2020.0258.

[8] S. Boon-Itt and Y. Skunkan, "Public Perception of the COVID-19 Pandemic on Twitter: Sentiment Analysis and Topic Modeling Study," JMIR Public Health and Surveillance, vol. 6, no. 4, p. e21978, Nov. 2020, doi: 10.2196/21978.

[9] W. Liu, Z. Wei, X. Cheng, R. Pang, H. Zhang, and G. Li, "Public Interest in Cosmetic Surgical and Minimally Invasive Plastic Procedures During the COVID-19 Pandemic: Infodemiology Study of Twitter Data," Journal of Medical Internet Research, vol. 23, no. 3, p. e23970, Mar. 2021, doi: 10.2196/23970.

[10] P. Moy, D. Tewksbury, and E. M. Rinke, "Agenda-Setting, Priming, and Framing," The International Encyclopedia of Communication Theory and Philosophy, pp. 1–13, Oct. 2016, doi:10.1002/9781118766804.wbiect266.

[11] Y. H. Yang, "Analysis of Publicness Criteria and Cases of Newspaper Language," Korean Language Research, vol. null, no. 28, pp. 115–140, Jun. 2011, doi: 10.16876/klrc.2011..28.115.

[12] S. Iyengar and A. Simon, "News Coverage of the Gulf Crisis and Public Opinion," Communication Research, vol. 20, no. 3, pp. 365–383, Jun. 1993, doi: 10.1177/009365093020003002.

[13] S. H. Lee, S. Shon, and H. W. Kim, "A text mining approach to the analysis of key factors for cosmetic plastic surgery," Knowledge Management Research, vol. 20, no. 1, pp. 45-75, 2019.

[14] S. Yoon and Y.-A. Kim, "Topic modeling for cosmetic surgery-related YouTube content," Journal of the Korean Data And Information Science Society, vol. 34, no. 6, pp. 865–874, Nov. 2023, doi:10.7465/jkdi.2023.34.6.865.

[15] A. Choudhary and E. Cambria, "Making Sense of Sentiments for Aesthetic Plastic Surgery," 2022 IEEE International Conference on Data Mining Workshops (ICDMW), Nov. 2022, doi:10.1109/icdmw58026.2022.00061.

[16] T. J. Lu, A. X.-L. Nguyen, X.-V. Trinh, and A. Y. Wu, "Sentiment Analysis Surrounding Blepharoplasty in Online Health Forums," Plastic and Reconstructive Surgery - Global Open, vol. 10, no. 3, p. e4213, Mar. 2022, doi: 10.1097/gox.0000000000004213.

[17] C. J. Didzbalis, R. Patel, C. C. Tseng, J. Weisberger, D. Bai, and E. S. Lee, "A social media data mining approach to understanding patient satisfaction in regard to mastopexy surgery," Journal of Plastic, Reconstructive & Aesthetic Surgery, vol. 76, pp. 322–323, Jan. 2023, doi: 10.1016/j.bjps.2022.10.001.

[18] D. M. Blei, A. Y. Ng, and M. I. Jordan, "Latent dirichlet allocation," J Machine Learning research, vol. 3, pp. 993-1022, 2003.

[19] D. Blei, "Probabilistic topic models," Proceedings of the 17th ACM SIGKDD International Conference Tutorials, Aug. 2011, doi:10.1145/2107736.2107741.

[20] A. Abdelrazek, Y. Eid, E. Gawish, W. Medhat, and A. Hassan, "Topic modeling algorithms and applications: A survey," Information Systems, vol. 112, p. 102131, Feb. 2023, doi:10.1016/j.is.2022.102131.

[21] J. Qiang, Z. Qian, Y. Li, Y. Yuan, and X. Wu, "Short Text Topic Modeling Techniques, Applications, and Performance: A Survey," IEEE Transactions on Knowledge and Data Engineering, vol. 34, no. 3, pp. 1427–1445, Mar. 2022, doi: 10.1109/tkde.2020.2992485.

[22] D. Maier et al., "Applying LDA Topic Modeling in Communication Research: Toward a Valid and Reliable Methodology," Communication Methods and Measures, vol. 12, no. 2–3, pp. 93–118, Feb. 2018, doi: 10.1080/19312458.2018.1430754.

[23] I. Vayansky and S. A. P. Kumar, "A review of topic modeling methods," Information Systems, vol. 94, p. 101582, Dec. 2020, doi:10.1016/j.is.2020.101582.

[24] D. Paranyushkin, "Identifying the pathways for meaning circulation using text network analysis," Nodus Labs, vol. 26, pp. 1-26, 2011.

[25] R. Grillo, "Bibliometric trending analysis of complications related to facial non-surgical aesthetic procedures: a retrospective study," Prosthodontics, vol. 71, no. 3, pp. 228–233, Sep. 2021, doi:10.5114/ps/140080.

[26] N. Kumar, A. D. Parsa, and E. Rahman, "A Systematic Review on the Current Trend in Nonsurgical Aesthetic Training for Knowledge, Skill, and Professional Identity Formation," Aesthetic Surgery Journal, vol. 42, no. 9, pp. 1056–1063, Feb. 2022, doi: 10.1093/asj/sjac020.

[27] T. L. Griffiths and M. Steyvers, "Finding scientific topics," Proceedings of the National Academy of Sciences, vol. 101, no. suppl_1, pp. 5228–5235, Apr. 2004, doi: 10.1073/pnas.0307752101.

[28] J. Cao, T. Xia, J. Li, Y. Zhang, and S. Tang, "A density-based method for adaptive LDA model selection," Neurocomputing, vol. 72, no. 7–9, pp. 1775–1781, Mar. 2009, doi: 10.1016/j.neucom.2008.06.011.

[29] J. Gan and Y. Qi, "Selection of the Optimal Number of Topics for LDA Topic Model—Taking Patent Policy Analysis as an Example," Entropy, vol. 23, no. 10, p. 1301, Oct. 2021, doi: 10.3390/e23101301.

[30] R. Deveaud, E. SanJuan, and P. Bellot, "Accurate and effective latent concept modeling for ad hoc information retrieval," Document numérique, vol. 17, no. 1, pp. 61–84, Apr. 2014, doi:10.3166/dn.17.1.61-84.

[31] A. Hamidian Jahromi, A. Arnautovic, and P. Konofaos, "Impact of the COVID-19 Pandemic on the Education of Plastic Surgery Trainees in the United States," JMIR Medical Education, vol. 6, no. 2, p. e22045, Nov. 2020, doi: 10.2196/22045.

[32] F. R. Grippaudo et al., "The impact of COVID-19 in plastic surgery departments: a comparative retrospective study in a COVID-19 and in a non-COVID-19 hospital," European Journal of Plastic Surgery, vol. 43, no. 5, pp. 645–650, Aug. 2020, doi:10.1007/s00238-020-01725-w.

[33] N. Joji, N. Nugent, S. Vadodaria, and T. K. Sankar, "Impact of COVID-19 on Aesthetic Plastic Surgery Practice in the United Kingdom," Journal of Plastic, Reconstructive & Aesthetic Surgery, vol. 74, no. 9, pp. 2311–2318, Sep. 2021, doi:10.1016/j.bjps.2021.05.020.

[34] G. K. Sharma and J. Asaria, "The Impact of COVID-19 on Patient Interest in Facial Plastic Surgery," Plastic and Reconstructive Surgery-Global Open, vol. 9, no. 10, p. e3890, Oct. 2021, doi:10.1097/gox.0000000000003890.

[35] M. Lem, J. K. Kim, J. T. Pham, and C. J. Tang, "Effect of the COVID-19 Pandemic on Global Interest in Plastic Surgery," JPRAS Open, vol. 37, pp. 63–71, Sep. 2023, doi: 10.1016/j.jpra.2023.05.002.