

Exploring Media Depiction of “Social Distancing” during COVID-19 using Topic Modeling and Word Correlation

Eun-Ho Yeo¹, Kyung-Woo Park², Daniel Lee³

¹Associate Professor, Communication and Media Studies, Plymouth University, USA,
eyeo@plymouth.edu

² Professor, Media and Communication, Dong-A University, Korea, pekawe@dau.ac.kr

³Professor, Business, Plymouth University, USA, sclee@plymouth.edu

Corresponding author: Kyung-Woo Park

Abstract: This study examined how English-language newspapers in South Korea depicted “social distancing” during the COVID-19 pandemic, using text mining techniques such as word-correlation analysis and topic modeling. The data consisted of 2,463 news articles published from January 20, 2020 to January 13, 2021 in the two major English-language newspapers in South Korea - *The Korean Times* and *The Korea Herald*. For analysis, the researchers extracted sentences that contained “social distancing” to make a corpus. The corpus contained 4,566 sentences. For topic modeling analysis, this study used Latent Dirichlet Allocation (LDA) which views each document as a mixture of topics, then considers each topic a mixture of words. The word-correlation was calculated at the sentence-level, not at the article-level. In other words, the correlation values between “social distancing” and other words were calculated based on how frequently “social distancing” and the words co-occurred in the same sentences. In the analysis, the data was grouped according to five time-periods that were proposed by the Korea Disease Control and Prevention Agency (KDCA) based on the major changes in COVID-19 situations. Results indicated that media coverage related to “social distancing” focused on two distinctive topics: “spread and prevention” and “social impact.” Also, the word-correlation analysis showed that “social distancing” was more associated with “spread and prevention” than with “social-impact” of the pandemic. The findings of the study suggest a couple of implications: (1) The paradoxical social meaning of “social distancing” is apparent in the media depictions of COVID-19 (2) The media depiction of “social distancing” needs to provide more in-depth interpretations of “social distancing” concerning its impact on society.

Keywords: COVID-19, Korea Herald, Korea Times, Social Distancing, Framing, Media, News

1. Introduction

The first COVID-19 case in South Korea was officially reported on January 20, 2020 [1]. The Korean government has adopted social distancing, that the World Health Organization (WHO) recommended, as a measure of preventive behavior. Social distancing is keeping a safe space between people including cancelling face to face classes, working from home, and avoiding social gatherings to minimize the frequencies and intensities of human contacts [2]. In South Korea, social distancing policies were first suggested by The Korean Society for Preventive Medicine in late February 2020 and then adopted as a rule by the Korea Disease Control and Prevention Agency (KDCA). The KDCA

Received: March 21, 2021; 1st Review Result: May 07, 2021; 2nd Review Result: June 30, 2021

Accepted: July 31, 2021

initially set a three-tier social distancing scheme based on the degree of spread of the disease, then refined the scheme into five tiers on November 1, 2020. The new scheme began to be in effect from the 17th of November[2]. This social distancing scheme has become the basis of the behavioral guidelines for daily activities that are related to human interaction. In a sports event, for example, the number of spectators is to be reduced down to 50% at level 1, 30% at level 1.5, 10% at level 2, and no spectators are allowed at level 2.5 or higher[3].

While social distancing means a practical intervention in public health, it is “designed to reduce interactions between people in a broader community, in which individuals may be infectious but have not yet been identified hence not yet isolated”[4]. The concept of social distancing not only “describes the relationship and groups in society” but also “captures a variety of relations of difference, such as a social class, race, ethnicity, sexuality, or physical ability as well as the fact that groups may be close spatially”[5].

Kim[6] argues that social distancing has become a symbol that has social viability in our everyday lives. While “social distance” generally refers to a physical distance, it conveys, under COVID-19, a normative power which justifies antipathies towards those who continue religious or social gatherings without wearing masks. What justifies the normative power, according to Kim, is the anxiety and fear which transformed the meaning of society as a risk – an inevitable space in which people can get infected or get others infected. Simply put, connecting to other people, which is an essential element of being a member of society, has become a potential threat, and normalized “social distance” reflects the transformation of the meaning of society.

The media plays an important role in disseminating societal information on science and health. The media transform the scientific knowledge into lay person’s vocabulary, which enable the public to understand the meaning. The way the media constructs information affects public understanding of social distancing. Public behavior depends on how the public understands new prevention policies, such as “social distancing”[7].

Social distancing is considered to be one of the best preventive health protocols against the spread of COVID-19, and yet potentially undermines the necessary connections among community members. As social institutions, media carries stories and/or information about society, providing interpretations of the complexities of reality[8]. In this process of everyday reporting, realities are constructed with particular forms and directions. When the media disseminates stories and information about social distancing, they are constructing social realities. Analyzing how the media constructs stories about social distancing provides insights for understanding how the media constructs realities. This study is aimed to identify how English-language newspapers in Korea depicted social distancing. Such analyses also render opportunities for perusing the shape of society implied in the media under COVID-19. Specifically, this study is focused on exploring the media depictions of “social distancing” and their social implications, not the depictions of COVID-19 in general. Thus, the main research question of this study is “How is social distancing depicted in the news stories?” This research question aims to explore how English-language newspapers in Korea present “social-distancing” concerning its impact on people’s lives and on society.

2. Theoretical Background

Media scholars have been interested in how media reporting captures certain aspects of the issue that it covers. One of the most common approaches to discovering how the media depicts a certain issue is to investigate the semantic associations in the text. For example, Jeon[9] utilized corpus analysis to investigate media coverage on contagious diseases such as Zika Virus and Lyme disease. The corpus analysis revealed that a majority of the words used in the headlines had negative sentiment, which is against the reporting guidelines for infectious diseases. In the follow up

interviews, the reporters suggested that the overheated competition among the press companies excelled the use of provocative expressions in news reporting. Jin and Chung[10] also analyzed the semantic associations based on a network analysis of the words in news reporting about the Middle East Respiratory Syndrome (MERS) outbreak in 2015. Based on their analysis of news styles and semantic associations among Korean and foreign news reporting, the researchers concluded that Korean news reporting often focused on the "effects" and "danger" of MERS while foreign news reporting contained more information on the "contagion" process and "preventive behavior" as well as relevant world news. Some studies utilized a text mining technique, an approach currently gaining popularity among media scholars, when investigating news reports about a pandemic such as COVID-19. For example, Boon-Itt and Skunkan[11] analyzed 107,990 twitter messages from December 13 to March 9 in 2020 that are related to COVID-19 with text mining techniques including topic modeling and sentiment analysis. The results of the topic modeling analysis yielded three themes in the text: COVID-19 pandemic emergency, how to control COVID-19, and reports on COVID-19.

To find how social distancing was depicted in news reporting, this study adopted text mining techniques as suggested by Silge and Robinson[12]. Silge and Robinson explained that text mining is a process that integrates diverse approaches including machine learning, data mining, and statistical linguistics, and enables researchers to discover relationships and patterns that exist in unstructured data. It consists of a set of methods for analyzing unstructured data and discovering patterns to create an effective approach to analyze how words are used in unstructured data.

3. Method

3.1 Research Design: Topic Modeling and Word Correlation

Unlike traditional media framing research, this study used automated data analytic approaches which appears to provide considerable potential for examining the themes used in depicting a specific issue in the news stories. In particular, this study used a couple of text mining techniques: word correlation analysis and topic modeling. Word correlation refers to the relationship between two words, indicating how often they occur with each other and how often they occur separately in the text.

Topic modeling is a method for finding natural groups of items that emerges from the text based on the classification of the text. To fit a topic model, this study utilized Latent Dirichlet Allocation (LDA) which is a broadly used algorithm for topic modeling. Using the "topicmodels" package in R, this study created a two-topic LDA model. This modeling process renders each word's probabilities of being included to each topic (the probability value is called "beta") which in turn let us identify the most common words in each topic.

Using word correlation analysis, this study identified the words that are most associated with "social distancing" in the text to gain an insight on how social distancing was depicted in the news stories. In order to analyze what words are more associated with social distancing than others, the word correlations between social distancing and other words were calculated in a sentence level. The degree of association was indicated by phi coefficient (ϕ), a common measure for binary correlation. Phi coefficient indicates how much more likely it is that either both words appear, or neither do, than that one appears without the other[12]. Before analyzing the text, using "stop_words" function in R, the researchers removed stop words from the text. The R function defines stop words as the extremely common words in English such as "the", "in", "to" and so on. The phi coefficient was calculated separately according to different time periods. For each time period, ten words that are most closely associated to social distancing were selected.

$$\phi = \frac{n_{11}n_{00} - n_{10}n_{01}}{\sqrt{n_{1.}n_{.0}n_{.0}n_{.1}}} \quad (1)$$

3.2 Data Collection

This study analyzed the titles and bodies of the news articles published by two major English-language newspapers published in Korea. Even though English language newspapers play an important role in disseminating information about Korea to the whole world, very few studies have been conducted on how these newspapers depict Korean society during the COVID-19 pandemic, let alone social distancing. News articles published from January 20, 2020, when the COVID-19 case was reported for the first time in Korea, to January 20, 2021, were collected from *The Korean Times* and *The Korea Herald* websites using the key words, "Social Distancing" and "Social Distance." Initially, 1,247 news articles from *The Korean Times* and 1,407 from *The Korea Herald* were collected, a total of 2,641 news articles. Then, the data corpus was constructed only with the sentences that contain “social distancing” in them. Each sentence was also cleaned by removing stop words.

3.3 Data Set

After this cleaning process, 2,463 news articles were put into analysis. The news articles were grouped according to different time periods which had been suggested by the Korea Disease Control and Prevention Agency (KDCA) concerning the development of COVID-19 situation in South Korea[13]. The first period was from January 20 to February 17 in 2020. During this period, the first case of COVID-19 occurred in South Korea, followed by sporadic infection cases. The second period was from February 18 to May 5 in 2020. In this period the first wave of mass contagion occurred mainly in Daegu-Gyeongbuk area, and the South Korean government started intensive testing and launched a control program. The third period was from May 6 to August 11 in 2020 during which time the contagion began to appear in Seoul-Gyeonggi area while the daily number of COVID-19 infection cases was still held until 50. The fourth period was from August 12 to November 12 in 2020. During this time, the daily number of COVID-19 infection cases rose to around 100 with many infection cases occurring primarily among the senior population. The number of severe cases and fatality rate rose rapidly in this period. The fifth period started after November 12 in 2020. During this period, the spread became nationwide, and the daily number of COVID-19 infections increased up to about 100. The third wave of nationwide spread occurred, and the majority of infection cases were found in Seoul. The last day of data collection, January 13 in 2021, fell within this period. There were no news articles that contained “social distancing” during the first period, while there were 495 articles during the second (February 18 ~ May 5, 2020), 576 during the third (May 6 ~ August 11, 2020), 748 during the fourth (August 12 ~ November 12, 2020), and 644 in the fifth period (November 13 ~ January 13). The number of sentences that contained “social distancing” was 885 for the first period, 860 for the second, 1,471 during the third, and 1,350 for the fifth period [Table 1].

[Table 1] Data Set

	Feb. 18 ~ May 5, 2020	May 6 ~ Aug. 11, 2020	Aug. 12 ~ Nov. 12, 2020	Nov. 13, 2020 ~ Jan. 13, 2021	Total
News Articles	495	576	748	644	2,463
Sentences	885	860	1,471	1,350	4,566

3.4 Data Set Analysis

To find two distinctive frames, or themes based on which the news stories were constructed concerning social distancing, topic modeling analysis technique was used. The two distinctive clusters yielded by topic modeling process were interpreted as the emerging themes based on which the news stories were constructed. To name of each cluster was defined by identifying the words that has greatest difference in their probabilities of being included in the clusters.

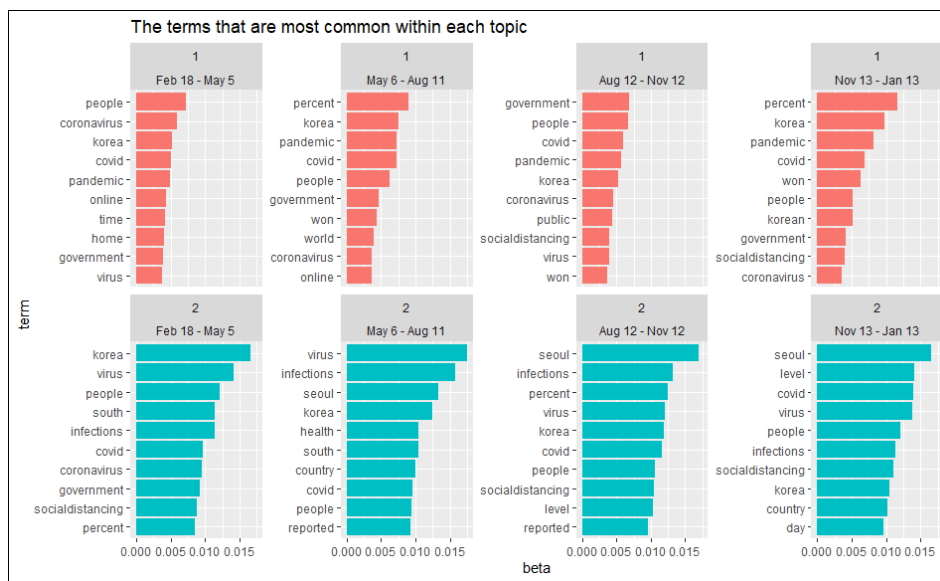
To investigate how social distancing was depicted in relation with other words, word correlation analysis was conducted on the assumption that the high correlation value between a word and “social distancing” reflects the close semantic relations between the two.

4. Results

4.1 Topic Modeling

The topic modeling process was conducted for each period separately to identify the most common words for each topic in each period. The LAD process permits words to be shared between topics. For example, a word like “social distancing” appeared in both topics. The appearance of common words in both topics made it difficult to identify the themes in the topics merely by identifying the words that appeared in each topic.

The difference between the two topics in news stories related to “social distancing” is not immediately perceivable by looking at the sets of most common words in each topic [Fig. 1].

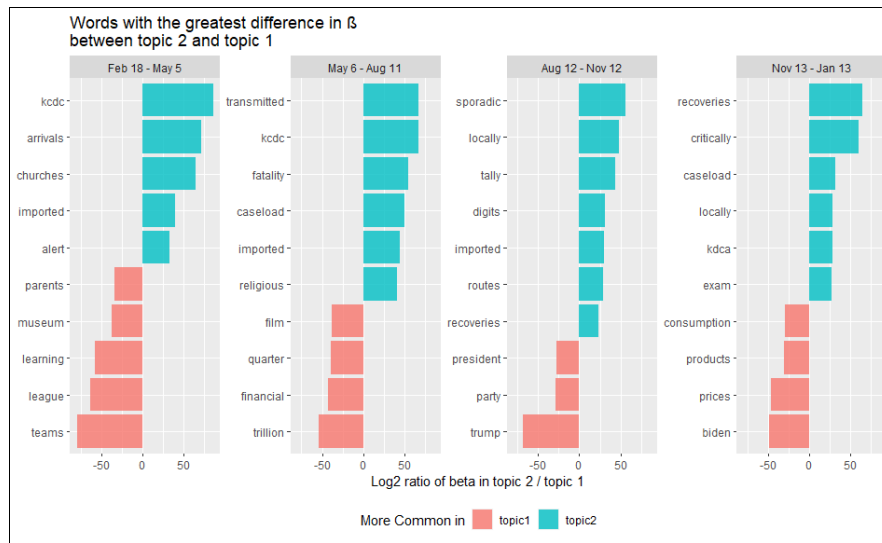


[Fig.1] Common Words in Two Topic Model

To find the contrasting themes between the two topics, this study identified the words that had the greatest differences in beta between topic 1 and topic 2. The differences were calculated based on the log ratio of the two beta values (one for topic 1 and the other for topic 2) of each word (2).

$$\text{Greatest Difference in Beta} = \log_2 \left(\frac{\beta_2}{\beta_1} \right) \quad (2)$$

The difference between the two topics is clear when the set of words that have “great difference in beta” is identified in each topic[Fig. 2].



[Fig.2] Words with Difference Between Topics

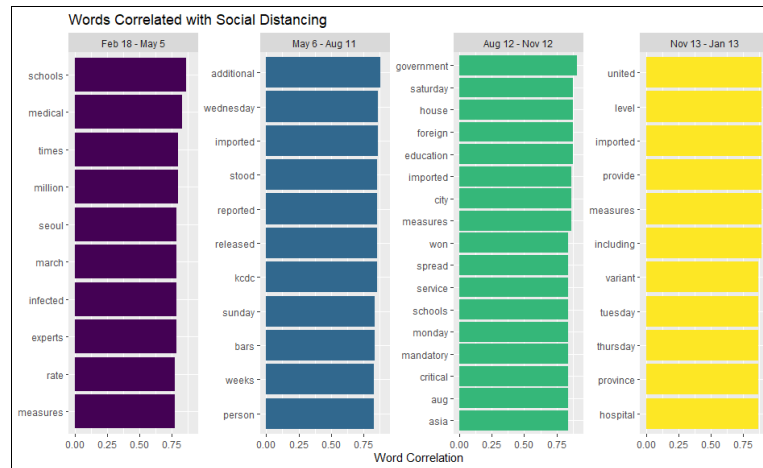
The results implied that one of the topics (topic 1) involved stories about “Social Impacts” while the other (topic 2) was related to the “Spread and Prevention” of the virus. For example, in period 1, the topic 1 words that have “great difference in beta” included KDCA, ARRIVAL, CHURCHES, IMPORTED, and ALERT. These words are related to the spread and prevention of COVID-19. On the other hand, in topic 2, words that have “great difference in beta” included PARENTS, MUSEUM, LEARNING, LEAGUE, TEAM. The set of words included in topic 2 suggested that the theme of topic 2 is related to the changes in social environment as a reaction to the virus. The beta value of “Social distancing” for topic 2 was greater than that for topic 1 in all periods of time [Table 2], which indicated that “social distancing” was more related to topic 2 than it is to topic 1, which means that “social distancing” was used more in the context of “spread and prevention” of the virus rather than in the context of “changes of social environment.”

[Table 2] Beta for “Social Distancing”

	Feb. 18 ~ May 5, 2020	May 6 ~ Aug. 11, 2020	Aug. 12 ~ Nov. 12, 2020	Nov. 13, 2020 ~ Jan. 13, 2021
Topic 1 (Social Impact)	.0031	.0036	.0039	.0040
Topic 2 (Spread and Prevention)	.0087	.0069	.0105	.0111

4.2 Word Correlations

The ten most associated words to “social distancing” in news reporting during each period are identified by their word correlations to “social distancing” [Fig. 3]. There appear more than ten words in some periods because some the correlation coefficient values were the same for some words. For example, in the second periods in Figure 3, the correlation coefficients for four different words were the same: Sunday, Bars, Weeks, and Person.



[Fig.3] Social Distancing Word Correlations

4.2.1 Word Correlations in the News (February 18 ~ May 5)

The period from February 18 to May 5 was the time when the first wave of mass contagion occurred mainly in Daegu-Gyeongbuk area, and the South Korean government started intensive testing and launched a control program. Most of the words highly associated with “social distancing” were directly related to the development of the pandemic and prevention measures. As for social impact, the news stories related to social distancing were focused on the COVID-19 situation in SEOUL area, and the impact of social distancing policies on SCHOOL activities:

“A social distancing campaign, suggested by the **Seoul** metropolitan government, is aimed at preventing the spread of the new coronavirus by encouraging citizens to stay at home and shun public gatherings to reduce the chances for them catching the virus.” (KT, March 10)

“We will limit the number of visitors to the preview exhibition and the auction to ensure social distancing. We will also suggest written and phone bidding for those who want to make a bid,” a **Seoul** auction official said. (KT, March 18)

“The government has played a part in encouraging social distancing, and has taken some draconian measures, most notably by closing **schools** until the middle of April at least.” (KH, March 9)

“Despite the government's guidance, more cram **schools**, known as hagwon, seem to be resuming operations. Given the desperate need for social distancing amid lingering concerns over mass infections, the government should encourage them to suspend operations voluntarily by promising emergency loans. No less important are schools' thorough disinfection measures, including rearranging desks and chairs to widen the distance between students, before the delayed new semester begins.” (KT, March 18)

4.2.2 Word Correlations in the News (May6 ~ August 11)

During the following period, from May 6 to August 11, the contagion began to occur in Seoul-Gyeonggi area while the number of daily infection cases was still held at or under 50. The news coverage related to social distancing mainly dealt with how the new policies impacted on the spread of the virus. The focus of area was BARS where the new policies are often overlooked and cause subsequent infections. It is notable that BARS represents one of the ways how people reacted to social distancing policies:

“The recent infections are believed to have occurred while the government's social distancing

scheme was in place. But the patients were found not to have worn face masks inside the clubs and **bars**, according to the KDCA.” (KH, May 8)

“To quench their thirst for social interaction, people started to gather at pubs, nightclubs and **bars** amid a series of public holidays in late April and early May, coupled with the relaxation of the social distancing campaign.” (KH, May 10)

From August 12 to November 12, the number of daily infection cases, the number of severe cases, and fatality rate rose rapidly. The news reporting associated with “social distancing” frequently depicted the situation being **CRITICAL** and emphasized the **MANDATORY** policies along with addressing the situations in other countries often in **ASIA**. Social connections with **FOREIGN** countries and investors were often discussed. Due to the change of school closing policies, **EDUCATION** issues were discussed frequently:

“Saying that the current social distancing measures must be followed strictly to have the desired effect, Jung stressed that despite the fall in daily figures, the situation remains **critical** with more than 200 cases being reported on a daily basis.” (KH, August 31)

“After the country observed a new surge of cases especially in the metropolitan area, the government implemented stricter social distancing measures, which made it **mandatory** for restaurants and coffee shops to offer only takeout food and beverages after 9 p.m.” (KT, September 20)

“... one of the biggest international film gatherings in **Asia**, aims to discover and support new film talents in the region. around 200,000 people have attended the festival annually until now, but the organizers are unsure how many people will be able to join this year... with **foreign** guests unable to enter the country and strict social distancing in effect nationwide. If all goes as planned, the festival will take place Oct. 7-16.” (KH, August 31)

“**Foreign** IBs' downgrade of South Korea's growth outlook came as Seoul adopted tougher social distancing measures in late August to cope with a surge in coronavirus cases in Seoul and the surrounding Gyeonggi province.” (KH, October 12)

“...understand that there are many worries and concerns of teachers, students and parents due to the social distancing campaign being hiked to level two...the ministry of **education** will work with regional education offices to fill the gaps of safety nets in terms of education.” (KH, August 20)

“The ministry of **education** said on Friday that schools in Seoul and its surrounding cities will remain online-only until Sept. 20, in accordance with the government's decision to extend stricter social distancing rules in the area.” (KT, September 4)

“According to the Seoul metropolitan office of **education**... from Oct. 12, first graders at elementary and middle schools should attend school every day even if the country is operating level 1 or 2 social distancing measures...” (KT, September 18)

4.2.3 Word Correlations in the News (November 13 ~ January 13)

The last period during which the data were collected had started on November 13, 2020. The data collection ended on January 13, 2021. During this period, the third wave of spread occurred nationwide. As the social distancing schemes were set up and applied (**LEVEL**), the news stories associated with “social distancing” frequently addressed the situation in the **United** States, comparing the situation with that in Korea. Beginning in December, the warnings about the **VARIANT** of the virus appeared frequently associated with “social distancing”:

“With signs of a possible slowdown, however, South Korea has kept the **level 1** social distancing scheme under a new five-tier system nationwide since earlier this month, although some cities and provincial governments upped their virus infection preventive measures.” (KH, November 14)

“Disney's theme parks in Florida and those outside the **United** States reopened earlier this year

without seeing new major coronavirus outbreaks but with strict social distancing, testing and mask use.” (KT, November 26)

“Under level 3 social distancing measures, gatherings of 10 people or more are banned, including all sporting event, and schools can only provide online classes... less strict than the lockdown measures applied in the **United** States and Europe, but it is also aimed at minimizing social and business activities in a wide range of areas.” (KT, December 12)

“As to the U.K. coronavirus variant, five cases have been confirmed since Monday. Concern is rising that if the **variant** takes root here, the virus will spread even faster, and the current social distancing rules may be insufficient to curb infections.” (KT, December 31)

5. Discussion

The results of topic modeling showed that the news stories which contained “social distancing” can be categorized by two distinctive themes: “Social Impact” and “Spread and Prevention”, which suggests that the news stories about social distancing were constructed with two distinctive frames. Among the two themes, “Social distancing” was conceptually closer to “Spread and Prevention” than to “Social Impact”, which means news stories about social distancing were more focused on the aspect of “Spread and Prevention.” The emphasis of “Spread and Prevention” of the news stories was consistent with what Kim[6] argued: social distancing has become a symbol that has social viability in our everyday lives and conveys normative power. Word correlation analysis of the sentences supported the implication that the media depiction of social distancing gave relatively less attention to social impacts of social distancing. Lack of attention on social impact of pandemic in news stories was suggested in the previous studies. For example, Song and Cho[14] pointed out that the news reporting concerning pandemic outbreak in Korean broadcasting media often failed to grasp the multi-faceted nature of the outbreak, and the stories were reported in a superficial way, rather than providing an in-depth analysis. Although there were significant number of news stories that touched the changes in social processes due to social distancing policies, they hardly provided the multi-faceted nature of the implications of those policies.

6. Conclusion

The aim of this study is to explore how English-language newspapers in Korea present “social-distancing” concerning its impact on people’s lives and on society. Analysis of the news stories revealed that there were two distinctive themes in framing “social distancing” and that the “social impact” theme has been used less than “spread and prevention” theme in depicting “social distancing.” The findings suggest a couple of implications.

First, the paradoxical social meaning of “social distancing” is apparent in the media depictions of COVID-19, which means that the news stories concerning “social distancing” emphasized two contradictory aspects of the issue: (1) people need to keep the distance to maintain the safety of individuals and community (2) “social distancing” policies are threatening the connections among people which is necessary to maintain the community.

Second, the media depiction of “social distancing” is unbalanced. It needs to provide more balanced interpretations of “social distancing” concerning its impact on society as well as its importance and effectiveness for preventing the spread of COVID-19. As Žižek[15] rightly pointed out, horrible events like COVID-19 can have unpredictable social consequences. Media needs to provide the public more than straight news for the pandemic. A steady stream of information is necessary for optimize outcomes. However, the media needs to help the public have moments to think about what the

pandemic means for the society and their everyday lives.

A major limitation of this study is the scope of data. The English-language newspapers provide small fragments of conversations that occurs in Korean media. The results may not be applicable to other types of Korean media. Also, focusing on data analytic approach, this study did not consider the rich context in which word associations occurred. In the future research, it is suggested that broader range of media text will be analyzed with more sophisticated consideration of the context where “social distancing” is semantically associated with other concepts in the news stories.

7. Acknowledgments

This work was supported by the Dong-A University research fund.

References

- [1] Korea Disease Control and Prevention Agency, COVID-19, Press Release, http://ncov.mohw.go.kr/tcmBoardView.do?brdId=&brdGubun=&dataGubun=&ncvContSeq=352435&contSeq=352435&board_id=140&gubun=BDJ#, Jan 20, (2020)
- [2] Korea Disease Control and Prevention Agency, COVID-19, Social Distancing Scheme, <http://ncov.mohw.go.kr/socdisBoardView.do?brdId=6&brdGubun=1>, May 22, (2021)
- [3] J. Park, M. Choi, J. Kang, Spatial optimization of indoor sports stadium seats under social distancing practice during the COVID-19 pandemic, *Journal of the Korean Geographical Society*, (2021), Vol.56, No.1, pp.53-66.
- [4] A. Wilder-Smith, D.O. Freedman, Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel Coronavirus (2019-nCoV) outbreak, *Journal of Travel Medicine*, (2020), Vol.27, No.2, taaa020.
- [5] R. O. Jackson, Black immigrants and the rhetoric of social distancing, *Sociology Compass*, (2010), Vol.4, No.3, pp.193-206.
- [6] H. Kim, COVID19 and social theory: centering on virus, social distancing, and droplets, *Korean Journal of Sociology*, (2020), Vol.54, No.3, pp.163-187.
- [7] R. Jaspal, B. Nerlich, Social representations, identity threat and coping amid COVID-19, *Psychological Trauma: Theory, Research, Practice and Policy*, (2020), Vol.2, S1, pp.249-251.
- [8] M. Schudson, *Discovering the news: a social history of American newspaper*, (Translation): K. Park, E. Yeo, *Discovering the news: a social history of American newspaper*, USA: Communication Books, (2019)
- [9] J. Y. Jeon, A Study on Word Choice in Korean Media Reporting Infectious Disease - Focusing on Zika Virus, *Haemaphysalis longicornis and the Multidrug Resistant Organisms -*, *Crisisonomy*, (2017), Vol.13, No.1, pp.1-15.
- [10] N. Jin, C. J. Chung, Semantic Network analysis of domestic and overseas media coverage regarding Korea MERS, *Journal of Communication Science*, (2018), Vol.18, No.2, pp.222-262.
- [11] S. Boon-Itt, Y. Skunkan, Public perception of the COVID-19 pandemic on Twitter: sentiment analysis and topic modeling study, *JMIR Public Health and Surveillance*, (2020), Vol.6, No.4, e21978.
- [12] J. Silge, D. Robinson, *Text mining with R: A tidy approach*, USA: O'Reilly Media, Inc., (2017)
- [13] Korea Disease Control and Prevention Agency, http://ncov.mohw.go.kr/tcmBoardView.do?brdId=3&brdGubun=31&dataGubun=&ncvContSeq=4541&contSeq=4541&board_id=312&gubun=ALL, Dec 31, (2020)
- [14] H. Song, H. Cho, Study on the Characteristics of the Domestic Press' Disease-related Risk Reports - Focusing on the News Reports of Ebola Virus, *Crisisonomy*, (2015), Vol.11, No.6, pp.45-68.
- [15] S. Žižek, *Pandemic!: COVID-19 shakes the world*, USA: John Wiley & Sons, (2020)