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Establishing the role and desirable relationship between the government and medical personnel in the post-corona era in Korea

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Abstract---This study aims to analyse academic papers on the topic of coronavirus published in Korea, and, on that basis, to select important topics that should be addressed by policymakers. The study constructs an eco-network that includes two keywords, ‘government’ and ‘medical manpower’, and analyses it. The research results thus obtained may contribute to deriving policy information with which to respond to situations similar to the corona pandemic that may occur in the future. For this purpose, we analyse academic papers published during the two-year period from January 2020, when the first corona patient was first identified in Korea, to December 2021. As research methods, text network analysis and ego network analysis methods were applied. As a result, seven important policy tasks were derived. Among these policy themes, in particular the topic relating to citizen participation in medical law revision and quarantine processes was selected as representing the task to be resolved first.

Keywords---government and medical area, corona pandemic, text network analysis.

Introduction

In Korea, the first case of COVID-19 was reported on 20 January 2020 (<https://coronaboard.kr/>) Two years have passed since then, with the number of infected people continuously increasing and decreasing. As in other countries, the corona pandemic in Korea has had a huge impact on society. As of 31 December 2021, the cumulative number of corona patients in Korea exceeded 3 million (<https://ncv.kdca.go.kr/>). Considering that the total population of Korea is 51 million, as of 31 December 2021 around 6 per cent of the total population was infected with COVID-19. For the foreseeable future, while the number of corona

patients is expected to continue to increase, experts predict that new variants will continue to appear. Due to the sudden onslaught of the corona pandemic, both the Korean government and the field of medicine have made strong efforts to end the pandemic at an early stage, while at the same time repeating various errors.

What was confirmed in this process is the fact that the two actors playing the most important role in the spread and containment of the corona pandemic are the Government and medical personnel (Choi, 2021a). The government has public power in establishing and executing the quarantine policy, and it may be said that medical personnel (doctors and nurses) directly implement the quarantine policy from a medical point of view. In other words, how the Government and medical personnel cope effectively with quarantine issues such as those involved in this pandemic is the most important issue to be addressed, not only now but also in the future. In particular, in a situation where variants of the virus are predicted to continue to occur, the relationship between the Government and the medical field is important; in particular, it is very important to quickly and effectively solve the problems facing these two bodies.

In recognition of this, this study analyses the issues that have emerged as important in the relationship between the Korean government and medical personnel during the previous two years of the pandemic, and draws out the policy implications that need to be considered in resolving these. In so doing, this study intends to utilize a new research methodology that has not been used in previous studies, aiming to derive more meaningful and useful implications via this process.

Theoretical discussion and research question setting

Even in Korea, COVID-19 has changed people's lives in many ways. After the first confirmed case in Korea in January 2020, what were initially small-scale and sporadic outbreaks gradually spread to become large-scale infections (Bae and Chang, 2021; Park et al., 2021; Jang, 2020). The World Health Organization (WHO) declared COVID-19 a pandemic on 11 March 2020, since when, people's daily lives have changed enormously. For the sake of preventing infectious diseases the Korean government prohibited many gatherings of people, and essential spaces were managed by measuring their density (Kwon, 2020; Huang, 2020). As a first stage, non-face-to-face classes and telecommuting became common in schools and commercial companies (Bond, 2020; Bozkurt and Sharma, 2020; Crawford et al., 2020; Fisher, 2020). All gatherings, eating out, and enjoying activities on public holidays and weekday evenings were prohibited. Overseas travel during the holiday season, which was a daily routine before COVID-19, became a vain dream, and domestic travel also became restricted to single families. Life in Korea has been completely changed by COVID-19.

Even more worrying is that the end of the pandemic is not in sight (Stewart, 2021). After a certain period of time, countries with high vaccination rates saw a sharp decrease in the number of confirmed cases of COVID-19 (Choi, 2021d; Stewart and Lowenthal, 2021). However, this situation did not last long. The viruses also seem to have evolved to survive (Bakar and Rosbi, 2020; Beaunoyer et al., 2020). Mutant viruses with higher degrees of contagiousness and lethality continued to

occur, and with the appearance of the mutant virus the number of confirmed COVID-19 patients began to increase again at home and abroad. It is beginning to be recognized that it is impossible for humankind to completely escape from COVID-19. Humans must find a way to coexist with COVID-19. This recognition means that the COVID-19 pandemic problem must be dealt with from a policy point of view, through developing and implementing policies that can continuously address this issue in both the medium and the long term (Sundarasan et al., 2020; Williamson et al., 2020; Barzilay et al., 2020; Bhuiyan et al., 2020; FP Analytics, 2021; Poudel and Subedi, 2020; Williams et al., 2020; Gao, et al., 2020). Judging by Korea's experience in dealing with these policy issues, the important factor here is the role of the Government and the medical sector. It was newly emphasized that government policies should undergo continuous improvement, and that at the same time co-operation in the medical field is important. There was a recognition that central government's quarantine policy should be implemented promptly and appropriately. In addition, a social consensus arose that the Government and the field of medicine should be closely linked, since the latter is the main body that professionally enacts quarantine arrangements.

So far, Korea, like other advanced countries, has not taken the quarantine problem seriously. It was initially perceived as a problem occurring in underdeveloped countries, but now, people have come to recognize that it must be dealt with in a mid-to-long-term perspective (Stewart, 2020; Kwon, 2020). What is important here is establishing what the Government and the medical sector should do together in detail. The problems having been identified, it is vitally necessary for government and the field of medicine to actively co-operate to solve them.

Up until now, little research on issues such as the corona pandemic has been carried out in Korea. The reason for this may be that Koreans do not have much experience in this kind of the pandemic. As a result, even academic studies dealing with the quarantine problem have not attempted any great range of different approaches in terms of research methodology. Most of the research relating to quarantine has used surveys and interviews as the main research method. However, the corona pandemic has accelerated the exchanging of information between patients and the general public through the Social Network Service (SNS), via which the Government is also offering compensation for damage to business caused by coronavirus.

In the same way, in terms of academic research methodologies involved in studying pandemics, the need to employ a variety of research methods, such as text network analysis and system dynamics methods, is increasing. The reason for this is that there is an increasing need to examine the policy and social issues relating to the pandemic using unstructured data, rather than for studies to be limited to standardized data. Nevertheless, there are not many cases in Korea of research methods such as social network analysis being used in studies dealing with medical issues such as the corona pandemic from a policy point of view. When conducting research with complex and atypical data, accurate results can be obtained only when a research method suitable for analysing such atypical data is applied (Easton, 1965).

In particular, as described above, in order to deal with quarantine issues such as those involved in the corona pandemic from a policy point of view, it is necessary to accurately appraise the interrelationship between the two main actors: the Government, and the medical sector comprising doctors and nurses. It is necessary to draw up a plan whereby these two actors can actively co-operate in the future. However, thus far little research has been conducted in this field. Therefore, this study aims to analyse the academic papers relating to corona published during the two-year period from January 2020 to December 2021, when the first COVID-19 case occurred in Korea. In analysing precisely the contents of these papers, it isolates the major issues relating to the relationship between the two main parties and identifies their main components. In addition, the causal relationship between the detailed policy variables constituting these important issues is analysed. Against this situational awareness, this study establishes the following research questions:

1. In relation to the COVID-19 pandemic in Korea, what are the key policy that have emerged vis-à-vis the relationship between the Government and medical personnel?
2. Among these topics, which is the most important?
3. How is the causal relationship between the policy variables constituting the policy topics actually formed?

Survey design

Papers to be analysed

Academic papers (including their abstracts) containing the keyword ‘corona’ published during the period 1 January 2020–31 December 2021 and registered in the Korea Citation Index (KCI) are subject to analysis.

Analysis procedure

First, using a collection of thesis abstracts, basic analysis is performed via word cloud analysis. Although this word cloud analysis does not provide a great deal of information, it has meaning as a rudimentary study because it allows us to examine the prevalence of the main keywords. Next, in order to analyse the relationship between the Government and the medical field, which is the core research purpose of this study, a so-called ‘ego network’, including the two keywords *government* and *medical manpower*, is constructed.

This means that, rather than the entire network constituting ‘corona’ as a keyword being analysed, the ego network that has relevance to the keywords ‘government’ and ‘medical manpower’ present among the entire network is intensively analysed by reconfiguring it. In the original, whole network analysis, analysis is performed by targeting the connection relationship between all actor pairs included in the actor set. In the ego network, by contrast, there is a set of actors that are the main analysis targets, called *ego*, and the connection relationship between these ego actors and the other actors, called *alter*, is collected and analysed as relation data. In this study, following the initial analysis of the entire network, the ego networks of ‘government’ and ‘medical personnel’

are constructed and analysed.

In analysing the ego network, first, topic analysis is performed (Choi, 2021a; Choi, 2021b; Choi, 2021c). The number of topics is limited to those that provide the most suitable results regarding the analytical aim of the study. After this, degree centrality analysis is performed. As a result, concentric circles are derived, and the variables that are included at their centre are determined. It can be assumed that the topic including the variables that are included at the centre of the concentric circles is the most important. Next, path finding network (PFnet) analysis is performed to determine the mutual causal relationship between the policy variables included in each topic. Using this method, it is easy to analyse the causal relationship between the policy variables included in each topic.

Analysis method

The text network and ego network analysis techniques used in this study are methods which to date have not been widely used in academic papers studying the quarantine problem in Korea. In terms of software, the Netminer 4.4 program is used. Using this program has the advantage of enabling us to directly import the papers listed in the KCI into the program and so analyse them. This analysis method has recently been widely used in the field of social science in the study of formal and atypical data composed of relational data. However, despite its usefulness, this analysis method has hitherto hardly been used in analysing the relationship between the Government and medical personnel in connection with the quarantine problem Korea has been experiencing recently. This study, by using the above methods, will draw out the implications required for offering solutions to the quarantine problem in a mid- to long-term perspective.

Analysis Result

Word cloud analysis

As discussed above, we attempted to derive academic papers containing *corona* as a keyword, including in their titles. Among papers published between 1 January 2020 and 31 December 2021, those containing the keyword *corona* in the title numbered 148. These papers were written by both single and multiple authors; the number of authors was 304, and the number of words included in these papers was 1,916. The results of word cloud analysis performed on the words included in the papers are shown in Figure 1.



Figure 1. Word cloud analysis result

Table 1 shows only those 20 words that appeared most frequently in the papers. *Corona* appeared 521 times and was the most frequently-appearing word, followed by *government*, which appeared 382 times, and then *medical* (283 times). *Medical personnel* appeared 208 times. (Here, ‘medical’ refers to medical practices that treat corona patients, and ‘medical personnel’ includes doctors and nurses as representing the main body of medical practice.)

Table 1
Words by frequency of occurrence

		1	2	3	4	5	6
		of Speech(F	Frequency	Word length	Name Type	uthor Keywo	Distance
1	코로나	proper Noun"	521.0	3.0	"_"	"False"	1.0
2	정부	proper Noun"	382.0	2.0	"_"	"False"	1.0
3	의료	nmon Noun"	283.0	2.0	"_"	"False"	1.0
4	의료인력	proper Noun"	208.0	4.0	"_"	"False"	1.0
5	대응	nmon Noun"	173.0	2.0	"_"	"False"	1.0
6	사회	nmon Noun"	163.0	2.0	"_"	"False"	1.0
7	영향	nmon Noun"	160.0	2.0	"_"	"False"	1.0
8	상황	nmon Noun"	124.0	2.0	"_"	"False"	1.0
9	정책	nmon Noun"	108.0	2.0	"_"	"False"	1.0
10	결과	nmon Noun"	108.0	2.0	"_"	"False"	1.0
11	정보	nmon Noun"	95.0	2.0	"_"	"False"	1.0
12	효과	nmon Noun"	77.0	2.0	"_"	"False"	1.0
13	원격	nmon Noun"	77.0	2.0	"_"	"False"	1.0
14	관련	nmon Noun"	76.0	2.0	"_"	"False"	1.0
15	감염병	proper Noun"	76.0	3.0	"_"	"False"	1.0
16	관계	nmon Noun"	75.0	2.0	"_"	"False"	1.0
17	중심	nmon Noun"	70.0	2.0	"_"	"False"	1.0
18	평가	nmon Noun"	69.0	2.0	"_"	"False"	1.0
19	인식	nmon Noun"	67.0	2.0	"_"	"False"	1.0
20	요인	nmon Noun"	63.0	2.0	"_"	"False"	1.0

Note: only 20 words are shown, in descending order of frequency of occurrence.

Topic analysis

On the basis of the word cloud analysis, an ego network containing the two words *government* and *medical personnel* was again constructed, and topic analysis conducted using the ego network. This analysis, also called topic modelling, is a technique for classifying the categories of topics that can best express a set of language texts. A specific word included in the network is not used for one topic only, but may be used for a plurality of topics. Thus, literature is a mixture of topics, and topics are a mixture of words. In this study the number of topics was set at between 4 and 10, and the analysis was performed several times. As a result, it was found that an appropriate explanation was possible when seven topics were constituted. The seven topics that were extracted are shown in Figure 2.

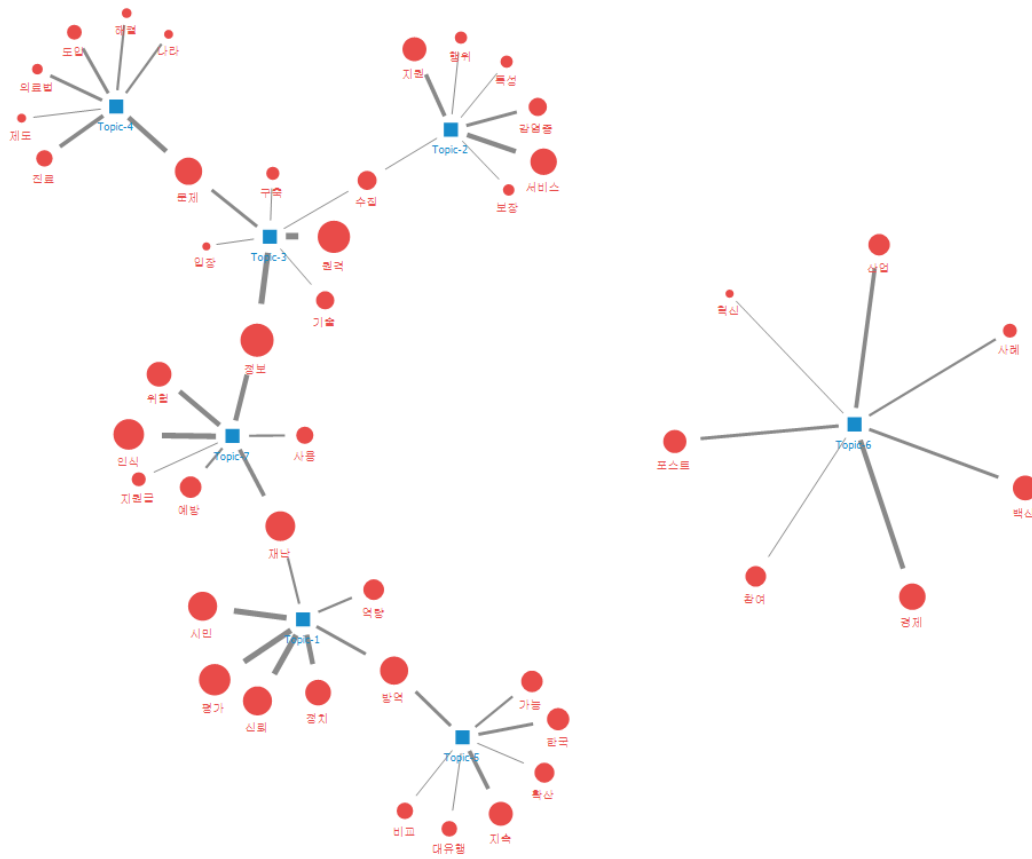


Figure 2. The seven extracted topics

From Figure 2, it can be seen that Topic 6 exists separately from the other six topics. In other words, while the other six topics are connected using certain words as a link, Topic 6 exists independently. In the following, the seven topics will be briefly reviewed.

Topic 1 consists of seven words: *evaluation*, *trust*, *politics*, *capacity*, *citizen*, *prevention* and *disaster*. Among these, the score indicating the relationship between *evaluation* and Topic 1 was the highest, at 0.136. Next comes *trust* (0.126), *citizen* (0.115), and so on. This topic may be said to be related to the ‘evaluation of quarantine capacity’. In particular, it should offer a reliable system for evaluating quarantine capacity, suggesting as it does that there should be no political intervention since it has become a system in which citizens participate. Scientific, not political, judgement should be the basis for designing a quarantine system relating to future Korean pandemics, and a reliable quarantine capacity evaluation system should be designed with the participation of citizens.

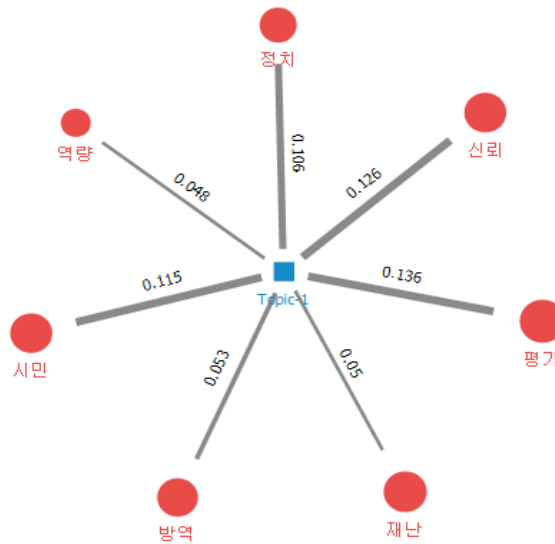


Figure 3. Topic 1: evaluation of quarantine capacity

Note: the score between links is a value indicating the degree of relationship with the topic.

As Figure 4 shows, Topic 2 consists of seven words: *service*, *guarantee*, *support*, *collection*, *infectious disease*, *characteristic* and *act*. Among these words, *service* had a score relating to Topic 2 of 0.09, which is higher than the other words' scores. Next was *support* with a score of 0.084, followed by *infectious disease* and *act*. In view of the composition and score of these words, Topic 2 may be said to be related to establishing a 'support system' connected with the pandemic. In other words: when a corona pandemic occurs, self-employed persons will suffer damage as a result of long-term control measures relating to quarantine, and so institutional design is necessary to provide appropriate support in the face of such damage.

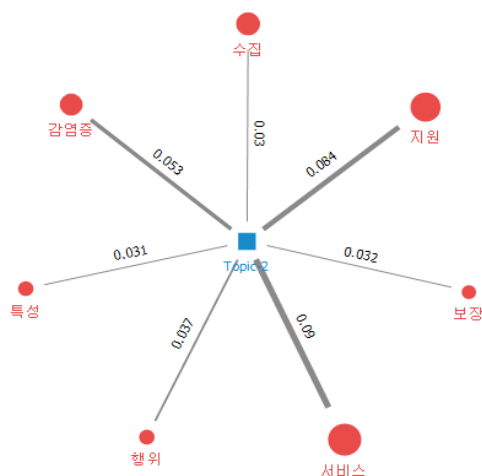


Figure 4. Topic 2: support system relating to the pandemic

Figure 5 shows Topic 3, which is made up of the words *remote*, *technology*, *information*, *collection*, *position*, *establishment* and *problem*. Among these words *remote* scores 0.218, which is a much higher score than that of the other words. Next comes *information*, which scores 0.164. Thus, Topic 2 is related to the ‘utilization of remote information and technology’. Owing to the corona pandemic, a need for technological development in the field of the use and development of remote information has been emerging. In Korea, this has been raised as a sharp social problem relating to the professional interests of doctors. In other words, if the Government allows remote medical practice, which is not currently legally permitted, it will run up against professional opposition from doctors, because they currently would have to expect a serious reduction in their profits. This problem needs to be addressed from the point of view of the public as well as medical personnel, in preparation for future pandemic situations caused by coronavirus mutations.

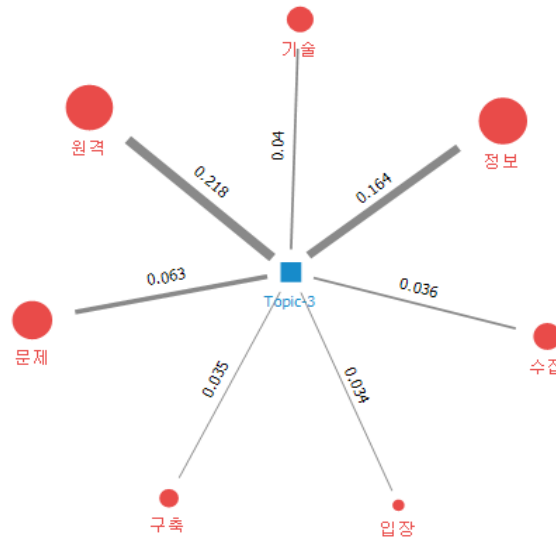


Figure 5. Topic 3: construction of remote medical practice information system

As Figure 6 shows, Topic 4 consists of the words *problem*, *treatment*, *medical law*, *system*, *introduction*, *solution* and *country*. *Problem* has a score of 0.099, and so has the closest relationship with Topic 4. Considering the scores of the other words, Topic 4 can be characterized as the ‘introduction of a new treatment system due to the revision of medical law’. This topic may be said to be connected in part to Topic 3 discussed above. It suggests the need to introduce a new treatment system by revising current medical law in response to the new treatment environment.

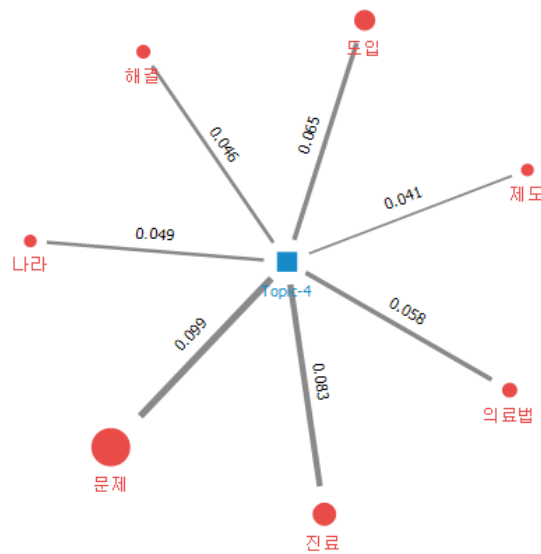


Figure 6. Topic 4: revision of medical law

Figure 7 explains the composition of Topic 5. Topic 5 consists of the words *sustainable*, *Korea*, *prevention*, *spread*, *pandemic*, *comparison* and *possible*. Of these, the word most closely related to Topic 5 is *continuation*, with a score of 0.076. Next come *Korea*, *prevention* and *possible*, in that order. Topic 5 suggests 'strengthening the continuity of the quarantine system' in preparation for the future spread of a pandemic. In other words, Topic 5 suggests the need to establish a sustainable quarantine system that will operate effectively in the mid to long term.

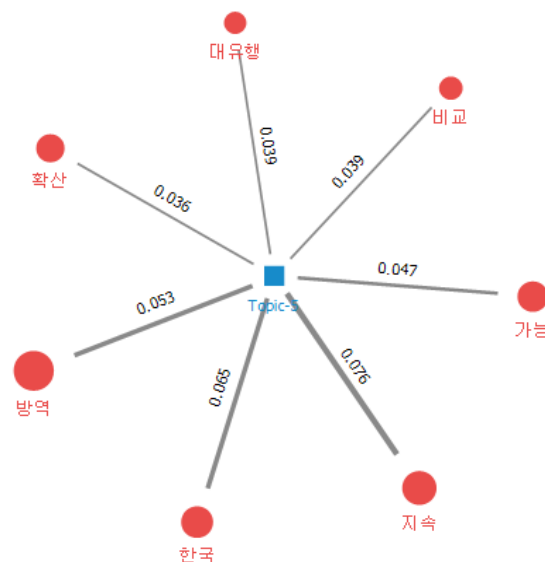


Figure 7. Topic 5: strengthening the continuity of the quarantine system

Figure 8 explains Topic 6. This consists of the seven words *industry*, *vaccine*, *participation*, *economy*, *innovation*, *post* and *case*. *Economy* was most closely related to Topic 6, with a score of 0.09, followed by *industry*, with 0.071. Next came *post* (0.061) and *vaccine* (0.055). Topic 6 emphasizes the importance of the economy in the post-corona era and the need for innovative industrialization of vaccines. It indicates, in other words, that in the post-corona era we should focus on vaccine development and industrialize this, eventually leading to economic development.

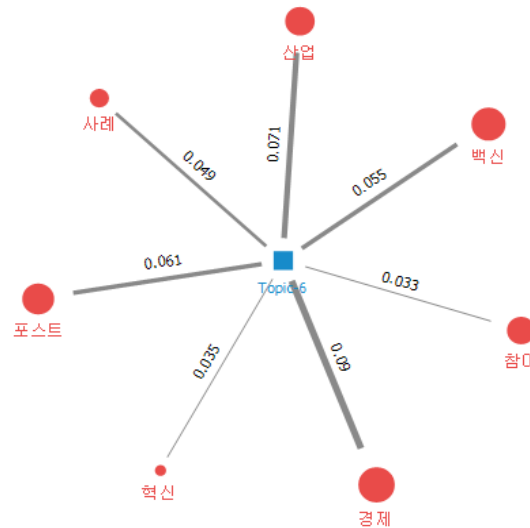


Figure 8. Topic 6: industrialization of vaccines from an economic point of view

As Figure 9 shows, Topic 7 consists of the seven words *risk*, *prevention*, *disaster*, *awareness*, *use*, *support* and *information*. Among these words *awareness* scores 0.163 and so is most closely related to Topic 7, followed by *risk* (0.108), *information* (0.091), *disaster* (0.088), etc. Topic 7 suggests that ‘disaster-level risk perception’ is necessary in a pandemic. In other words, a pandemic should be recognized as representing a disaster-level risk, and sufficient support should be provided to ensure prevention and limitation of the pandemic.

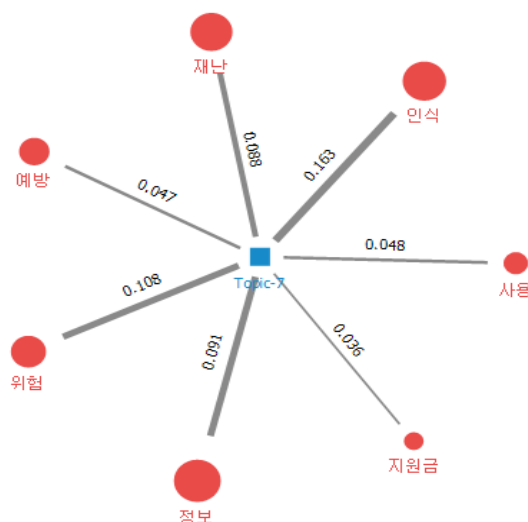


Figure 9. Topic 7: perception of risk of disaster level

As the above makes clear, all the policy topics arising from the relationship between the Government and medical personnel, which are the most important actors in the corona situation, can be summarized as numbering seven. They cover the assessment of quarantine capacity; the support system relating to the pandemic; the establishment of a remote medical practice information system; the revision of medical law; strengthening of the continuity of the quarantine system; the industrialization of vaccines from an economic point of view; and the recognition of disaster-level risk.

This shows that the Government and medical personnel should continue to play the most important role in situations such as a pandemic. Establishing a support system for medical personnel and victims when a pandemic occurs, responding to a new pandemic environment by establishing a remote medical practice information system, revising current medical law to fit the new environment, establishing a durable quarantine system, developing a vaccine as a countermeasure against a new infectious disease, industrializing vaccine development, recognizing the pandemic problem at the disaster level – all these things point to the need to approach these factors as related issues.

Selection of priority policy topics

Information is also needed as to which policy topic among the seven should be prioritized and resolved. For this purpose, degree centrality analysis and concentric circle analysis were performed. Such degree centrality analysis analyses the degree of interconnectedness of the words constituting the network, and concentric circle analysis can be performed in this analysis process. Table 2 shows the degree centrality scores of the words obtained by performing degree centrality analysis.

Table 2
Degree centrality score of words

		1	2
		In-Degree Centrality	Out-Degree Centrality
1	의료법	0.029791	0.029791
2	시민	0.029049	0.029049
3	도입	0.025259	0.025259
4	나라	0.021705	0.021705
5	정보	0.021559	0.021559
6	진료	0.021304	0.021304
7	정치	0.018485	0.018485
8	해결	0.018452	0.018452
9	방역	0.017217	0.017217
10	재난	0.016385	0.016385
11	인식	0.015753	0.015753
12	자원	0.014841	0.014841
13	문제	0.013932	0.013932
14	원격	0.013841	0.013841
15	사용	0.013648	0.013648
16	산업	0.013063	0.013063
17	평가	0.012685	0.012685
18	사례	0.012224	0.012224
19	역량	0.011395	0.011395
20	한국	0.010833	0.010833
21	지속	0.010747	0.010747
22	보장	0.009967	0.009967
23	포스트	0.009681	0.009681

Note: only the 23 words with the highest degree centrality score are shown

From Table 2, it can be seen that *medical law* and *citizen* have the highest degree centrality score. This suggests that medical law should be revised in response to the new medical environment and that citizen participation is important in the field of quarantine. From this point of view, Topic 1, which includes *citizen*, and Topic 4, which includes *medical law*, can be said to be particularly important policy topics. As the concentric circle analysis described below shows, *medical law* and *citizen* are located at the very centre of the concentric circle, indicating that they are of the utmost importance.

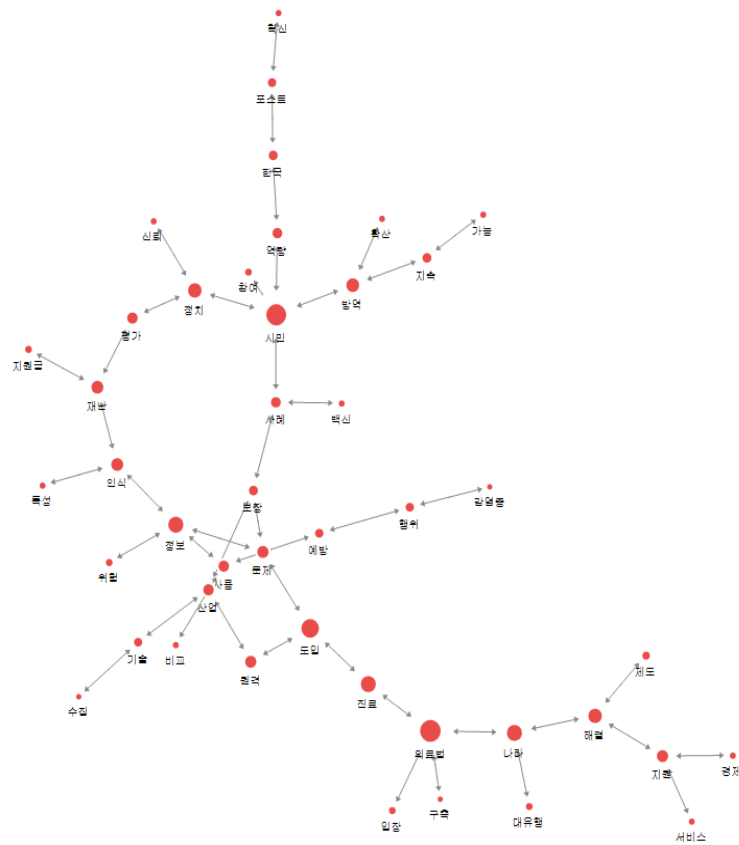


Figure 11. PFnet analysis result

Figure 11 shows how the interconnections between words included in the ego network are structured. Since the words included in the seven topics are connected according to the degree of the mutual relationship between them, this offers important implications for inferring the causal relationship between the words. Visually speaking, the words are interconnected centring on *medical law* and *citizen*, which have the largest node sizes. This connection relationship can be viewed by classifying it by cluster through clustering analysis.

In Figure 12, the degree of interconnection between words is shown, and the grouping results between words are presented. This indicates that the words included in each cluster can be regarded as detailed policies. In other words, the ‘support’, ‘disaster’, ‘awareness’, ‘characteristic’ and ‘evaluation’ clusters included at the top of the figure are clusters that mean that the pandemic should be recognized as a disaster-level event and thus that appropriate support should be provided. As an example: in this case, consideration should be given to appointing a policy officer to take charge of the disaster aid issue or setting up an organization dedicated to this issue. At the same time, this clustering analysis result can be utilized for system dynamics analysis that will analyse causal relationships by constructing a causal map between policy variables occurring in

the future. In this respect also, the implications of the cluster analysis results are considerable.

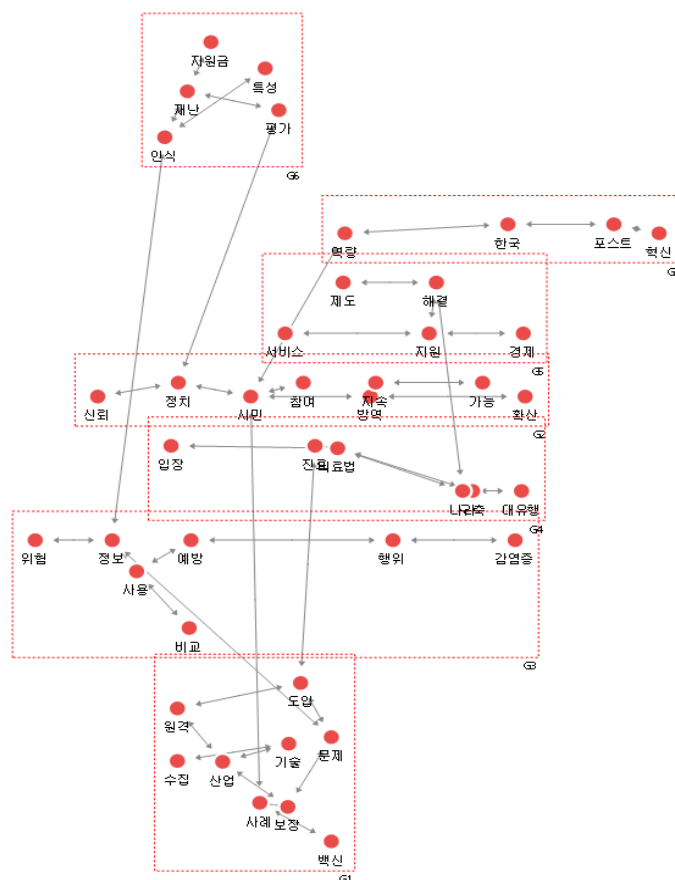


Figure 12. Clustering analysis result

This clustering analysis is different from the topic analysis performed above. If topic analysis is a method for deriving a mixture of words with similar characteristics by grouping policy topics, clustering analysis is an analysis method that allows mutual causality and connections between words to appear that are beyond the scope of these topics.

Conclusion

On 11 March 2020, the World Health Organization (WHO) declared the COVID-19 pandemic a global pandemic. It is true that Korea is experiencing serious difficulties in both economic and social dimensions. A pandemic situation such as that caused by coronavirus is unlikely to end in a short period of time, and it is predicted that situations similar to the current one will continue to arise as new mutants occur. Considering this situation closely, we should ascribe cardinal importance to the role of the most important parties: the Government and medical personnel. It is especially important that we identify the policy topics to be considered in the relationship between these parties.

The analysis conducted in this study revealed seven important policy themes. These themes were derived from the relationship between the Government and medical personnel. They were: assessment of quarantine capacity; establishment of a support system relating to a pandemic; establishment of a remote medical practice information system; revision of medical law; strengthening of the continuity of the quarantine system; industrialization of vaccines from an economic point of view; and recognition of disaster-level risk.

These policy topics do not represent matters that can be resolved simply. Not only the two major actors, but also academia, corporations and general citizens should be interested in these topics and should actively participate in discussing and resolving them. However, the Government and medical personnel are in a position to play the most important role should a pandemic situation occur in the future. In this process, they should evaluate Korea's current quarantine capabilities objectively and accurately grasp the situation, thus providing support for medical personnel and for victims in advance. There is also an urgent need to respond to the new pandemic environment by establishing a remote medical practice information system, which is still an issue.

Thus, it is important not only to revise current medical law to fit the new environment, but also to establish a quarantine system that guarantees continuity, and, furthermore, to develop vaccines as a countermeasure against new infectious diseases and industrialize vaccine development. Also, it is vitally necessary to take an approach that seriously recognizes the pandemic problem at the level of a disaster, and solves all pandemic-related problems on this basis.

Among the seven important policy themes, the issues that need to be addressed first are medical law and the participation of citizens. This was identified through degree centrality analysis. In other words, medical law should be revised in advance in response to a new medical environment such as is created by a pandemic. In addition, citizen participation is important in urgent quarantine sites such as operate in a pandemic. In this regard, among the seven policy themes derived from this study, Topic 1, which includes *citizen*, and Topic 4, which includes *medical law*, are particularly important. These results were confirmed through concentric circle analysis.

Meanwhile, we also analysed how the interconnections of words included in the ego network are structured. For this, PFnet analysis and clustering analysis methods were used. As a result it was possible to analyse what kinds of causal and connection relationships the words in the network have with each other beyond the scope of the subject. For example, as the cluster analysis results show, the 'support', 'disaster', 'awareness', 'characteristic' and 'evaluation' clusters included at the top of Figure 12 recognize the pandemic as disaster-level and provide subsidies and other resources. The cluster 'means' what it has to offer. For example, in this case, the idea might be put forward of setting up a separate department responsible for disaster aid. In this way, information concerning the remaining clusters can be utilized so that the results of cluster analysis can help to bring about detailed policy formation, the harnessing of related organizations, and legislation.

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