Original Article

A text mining analysis of perceptions of the COVID-19 pandemic among final-year medical students

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Aim: The coronavirus disease 2019 (COVID-19) pandemic has presented various challenges to medical schools. We performed a text mining analysis via essay task to clarify perceptions among final-year medical students toward the COVID-19 pandemic.

Methods: We posed the following essay question to 124 final-year medical students: "What should medical staff do during the COVID-19 pandemic; what should you do?" Responses were subjected to quantitative analysis using a text mining approach. Frequently occurring key words were extracted, followed by multidimensional scaling and co-occurrence network calculations.

Results: Of the 124 students, 123 (99.2%) responded to the essay question. The following seven key words were identified as high-frequency words: medical, infection, patient, human, myself, doctor, and information. Co-occurrence network calculations revealed that the word "medical" had a high degree of correlation with most key words, except for "doctor." The word "myself" was correlated with not only "medical" but also "infection," "human," and "doctor."

Conclusion: Our analysis of perceptions among final-year medical students toward the COVID-19 pandemic revealed that most medical students are strongly affected by the COVID-19 pandemic and are motivated to work as physicians among health care professionals.

Key words: COVID-19, education, medical student, perception

INTRODUCTION

CORONAVIRUS DISEASE 2019 (COVID-19), now a worldwide pandemic, has brought various challenges to not only hospitals but also medical schools.[1–3] Continuation of the clinical curriculum has become increasingly difficult due to the pandemic and social distancing rules.[4] Yet, workforce entry of final-year medical students should not be delayed, especially now as we face this health care crisis.[5] In addition, medical schools must instill in final-year medical students a professional mindset toward their future encounters with COVID-19 in the clinical setting as junior residents. To this end, there is a need to first understand the thoughts and preparedness of medical students in the present pandemic situation.

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This study aimed to clarify perceptions among final-year medical students toward the COVID-19 pandemic using an essay task and text mining approach.

METHODS

Ethical considerations

THE INSTITUTIONAL REVIEW Board of Osaka Medical College waived approval for this educational study under the condition that anonymity is maintained and that the study does not affect individual student records. Students were informed of the purpose of the survey and explained that their essay can be excluded from analysis if requested within 1 week after the deadline.

Medical school structure/curriculum in Japan

The duration of Japanese medical education is 6 years. Students are able to enter medical school soon after they graduate from high school. As with other medical schools in Japan, final-year medical students of Osaka Medical College

have undergone all basic and clinical medicine lectures and skill training before their clinical clerkships. In their 5th year, medical students undergo a basic clinical clerkship. In their 6th year, they participate in selective clinical clerkships and take a graduation examination.[6] Semesters begin in April.

At our medical school, final-year students participated in clinical clerkships uneventfully until March 2020. However, upon issuance of an emergency declaration by the government, clinical clerkships could no longer be continued, and education shifted toward online case-based training and essay tasks related to clinical attitudes and ethics. Among the themes of the essay tasks is COVID-19 and what students feel their role should be during the pandemic.

Essay on COVID-19

From April 6 to April 13, 2020, our school assigned an essay task to 124 final-year medical students, posing the following question: "What should medical staff do during the COVID-19 pandemic; what should you do?" The length of the essay was set to 1500–2000 Japanese words. Students submitted their essays online via Universal Passport (Japan System Technology, Tokyo, Japan) because physical entry into the school was prohibited during the study period.

Text mining methodology

Text mining can be used to extract information from larger samples of student essays in an efficient and objective manner, and identify patterns between learning situations to create models of the learning experience.[7,8] We analyzed student essays using KH Coder 3.0 (http://khcoder.net/en/index.html), a free downloadable multilingual text mining program developed by Koichi Higuchi at Ritsumeikan University.[7,9]

Essays were first combined into a single document and analyzed for frequently occurring words. Highly similar words that referred essentially to the same thing/concept were counted as the same word (e.g., "infection" and "COVID-19"). A brute-force approach to extract words from the combined document yielded nouns frequently used in the essays.

We next performed multidimensional scaling to analyze clusters. This method was used to identify words with a similar appearance pattern (i.e., close words tend to appear simultaneously, whereas far words do not).[7,9]

To further analyze the proximity between high-frequency words, co-occurrence network maps were generated based on the co-occurrence index.[8,9] Co-occurrence refers to how many times high-frequency words, that is, words used often and regarded as "key words," appear in the text in proximity to other high-frequency words. Text content is determined by relationships between co-occurring words, referred to as the "strength of inclusion," or more commonly, an association. The co-occurrence index ranges from 0 to 1, with 0 corresponding to the lowest occurrence and 1 to the highest occurrence.[8,10] Co-occurrence was calculated using Jaccard similarity co-efficient.[8,9] Co-occurrence network maps visualize how key words are grouped together throughout an entire text, and connecting lines marked with numerical values indicate association strength, that is, how often or how close together words occur in text.[8]

RESULTS

OF THE 124 final-year medical students, 123 submitted an essay (99.2%). None of the students asked to exclude their essay from analysis. Total word counts ranged from 981 to 1,856 (mean 1,568; SD 88). Word counts were equally distributed with no outliers.

Brute-force word extraction of combined essays (total, 96,365 words; unique words, 20,863) identified seven nouns that occurred most frequently: medical (1,225), human (468), infection (1,679), patient (567), myself (532), information (411), and doctor (304).

The results of multidimensional scaling are presented in Figure 1, showing that the relative distance between each word and the axis has small significance. There were a total of eight clusters, which could be divided into the following three major clusters: "Clinical state of the COVID-19 pandemic," "Attitude as medical students and future doctors," and "Attitude toward daily life."

Co-occurrence (i.e., the proximity of key words to other high-frequency words) is shown in Figure 2, along with degree values and the seven most frequently occurring terms clustering together.

Table 1 shows the degrees of co-occurrence between each key word. The word "medical" was highly correlated with most key words, except for "doctor." The word "myself" was correlated with not only the words "medical" but also "infection," "human," and "doctor."

DISCUSSION

DURING THE COVID -19 pandemic, medical students in some countries contribute to clinical roles by collaborating with health care workers to provide patient care.[4] In other countries, medical students experience unintended suspension in their education curriculum due to global university closures.[11] In either situation, students find themselves coping with mental and emotional

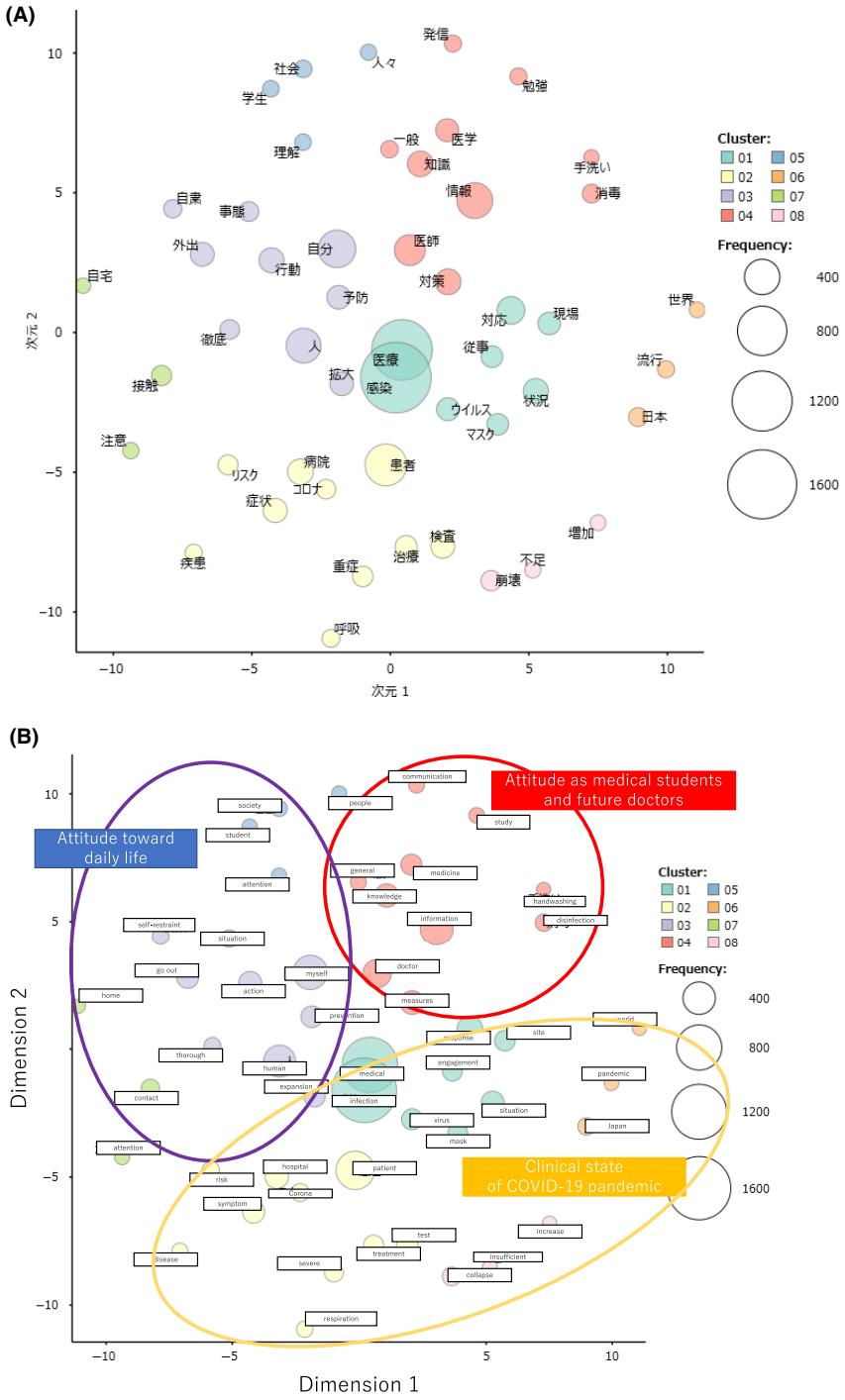

Fig. 1. Multidimensional scaling. (a) Japanese, (b) English.

issues, including stress, anxiety, and fear.[12] Medical students also experience difficulties with acquiring accurate information, which hinders their learning.[13] Therefore, it is essential for medical schools not only to address student mental health, but also to implement strategies to support their understanding of crisis management, self-mental care, and other principal measures in order to strengthen coping skills and preparedness.[13]

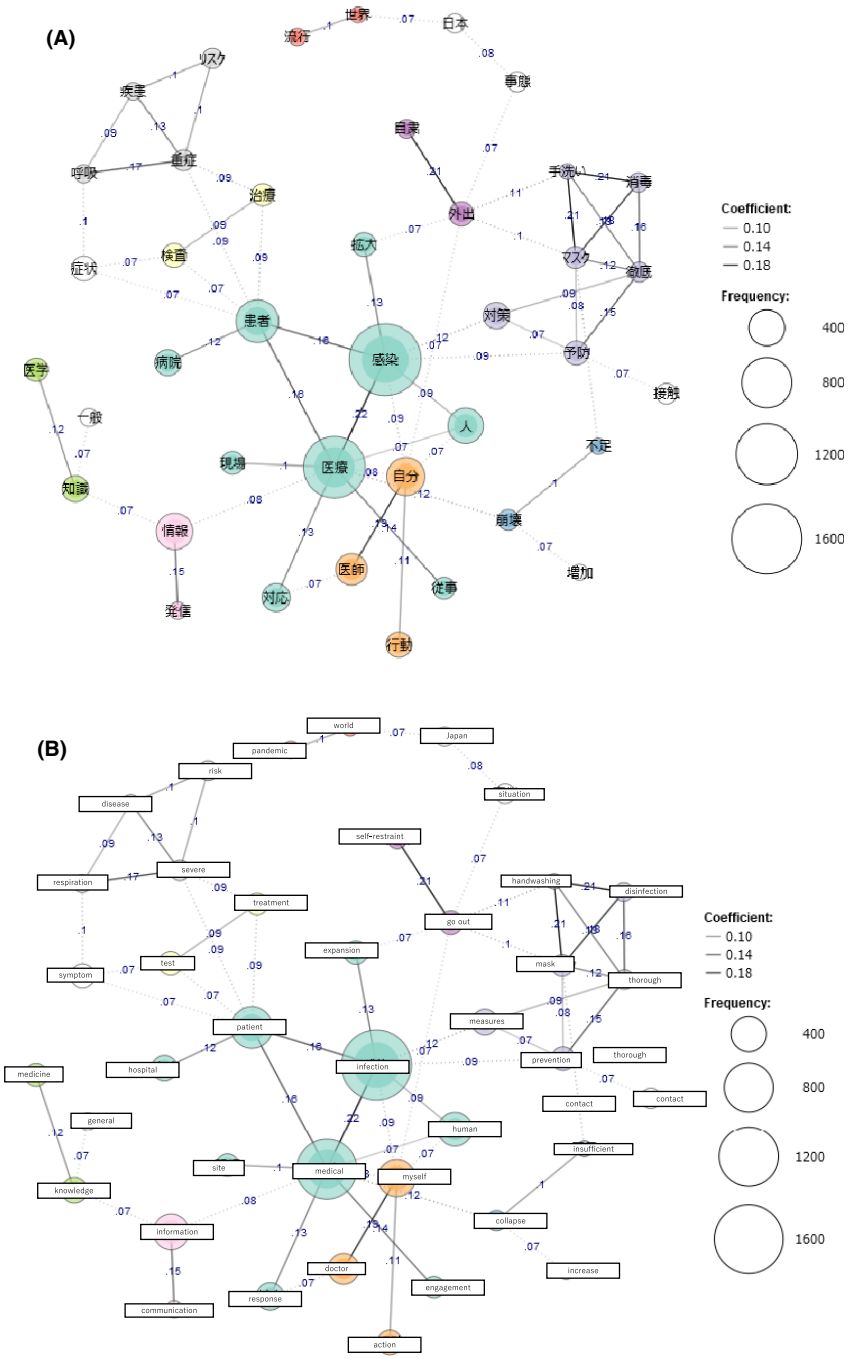

Fig. 2. Co-occurrence network map with degree values, with the seven most frequently occurring terms clustered together. (a) Japanese, (b) English. Coefficient was calculated as the Jaccard similarity index.

We presented the essay task to final-year medical students as a substitute for clinical clerkships for two reasons. First, it provides medical students with the opportunity to obtain accurate medical information about the COVID-19 pandemic, thereby preparing them to take appropriate actions as medical students.[14–16] Second, it clarifies their roles, cultivates their ability to self-study at home, and diminishes at least somewhat the stress from the unanticipated pandemic.[17]

Our text mining analysis of the essays revealed the following three major perceptions among final-year students:

Table 1. Degrees of co-occurrence between key words based on key word map (empty cells: <0.05)

	Medical	Infection	Human	Patient	Myself	Doctor	Information
Medical	NA	0.22	0.07	0.16	0.08		0.08
Infection		NA	0.09	0.16	0.09		
Human			NA		0.07		
Patient				NA			
Myself					NA	0.13	
Doctor						NA	
Information							NA

Coefficient was calculated as the Jaccard similarity index.
NA, not applicable.

"Clinical state of the COVID-19 pandemic," "Attitude as medical students and future doctors," and "Attitude toward daily life." These findings indicate that final-year medical students exercised self-control with respect to lifestyle attitudes, for example, by making efforts not to spread the virus. Moreover, students were strongly passionate about transitioning to doctors the next year and were aware of the role that they will play as new doctors. That is, they understood what they should "do" and what they should "not do" at present. Furthermore, students showed a tendency to obtain accurate information about COVID-19 epidemiology, prevention, and treatment. A high level of information literacy was clear from the results of text mining.

We believe that essay tasks on disaster management, such as the one described in this study, provide not only an opportunity to improve lifestyle attitudes but also a chance to cultivate a sense of risk management and enthusiasm to tackle future disasters.[18,19] Furthermore, sharing of essay contents may also influence the attitudes of younger medical students in a roof-tile manner.[20]

Because of the COVID-19 pandemic, countries around the world may begin to adopt new types of infection-prevention approaches. Valuable and significant lessons on disaster management gained from these disasters should be applied toward future prevention and management not only in the disaster region itself, but also globally. From the perspective of medical education curriculums, now is the time to integrate and develop international medical education collaborations. Undergraduate medical education which covers worldwide disaster prevention and management is warranted.[21,22]

One limitation of this study is that data were obtained from a single institution, and thus our findings may not be generalizable to other medical schools. Another limitation is that the essay question was posed as one of curriculum tasks. The high recovery rate associated with curriculum tasks might have resulted in bias. There is also a possibility that students may have presented themselves more favorably to get better grades. However, our results likely apply to other Japanese medical schools in Japan, given that the same core medical curriculum is adopted throughout the country.

In conclusion, we performed an essay task survey involving final-year medical students to clarify their perceptions toward the COVID-19 pandemic and what they feel their role should be during the pandemic. Our analysis revealed that most medical students are strongly affected by the COVID-19 pandemic and are motivated to work as physicians among health care professionals.

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AUTHOR CONTRIBUTIONS

N.K. AND R.S. contributed to the data collection of the survey; N.K. contributed to the statistical analysis; and F.T., T.N., and R.K. provided critical comments.

DISCLOSURE

Approval of the Research Protocol: Deemed unnecessary by the Research Ethics Committee of Osaka Medical College.
Informed Consent: N/A.
Registry and the Registration No. of the study/Trial: N/A.
Animal Studies: N/A.
Conflict of Interest: None declared.

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