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## Impact of general practice / family medicine clerkships on Japanese medical students : Using text mining to analyze reflective writing

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### Abstract

**Background :** In order for general practice / family medicine clerkships to be improved in undergraduate medical education, it is necessary to clarify the impacts of general practice / family medicine clerkships. Using text mining to analyze the reflective writing of medical students may be useful for further understanding the impacts of clinical clerkships on medical students.

**Methods :** The study involved 125 fifth-year Fukushima Medical University School of Medicine students in the academic year 2018-2019. The settings were three clinics and the study period was 5 days. The clerkships included outpatient and home visits. Students' reflective writing on their clerkship experience was collected on the final day. Text mining was used to extract the most frequent words (nouns) from the reflective writing. A co-occurrence network map was created to illustrate the relationships between the most frequent words.

**Results :** 124 students participated in the study. The total number of sentences extracted was 321 and the total number of words was 10,627. The top five frequently-occurring words were *patient*, *home-visit*, *medical practice*, *medical care*, and *family*. From the co-occurrence network map, a co-occurrence relationship was recognized between *home-visit* and *family*.

**Conclusion :** Data suggest that medical students may learn the necessity of care for the family as well as the patient in a home-care setting.

**Key words :** medical education, clinical clerkships, reflective writing, text mining, community medicine

### Introduction

General practice / family medicine (GP/FM) has become a clinical field that is not only expected to provide high-quality primary health care, but also to contribute to medical education<sup>1)</sup>. Furthermore, the World Health Organization has recommended increasing the opportunities for medical students to experience primary health care in the real world<sup>2)</sup>.

On the other hand, medical schools across the globe are currently undergoing curriculum reforms in accordance with the global standards of the World Federation for Medical Education<sup>3)</sup>. According to the Japanese version of these standards, GP/FM is highlighted as an important clinical discipline, which means that it is a mandatory subject for all medical students<sup>4)</sup>. Despite recognition of the importance of GP/FM, the opportunities for medical students to

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participate in GP/FM clerkships are still inadequate around the world. It was reported that 50 out of 259 universities (19%) had no or very brief GP/FM clerkships, even in Europe where GP/FM is further developed<sup>5</sup>. In order for GP/FM clerkships to be improved into undergraduate medical education, it is necessary to clarify the impacts of GP/FM clerkships<sup>6</sup>. Two important systematic reviews were reported in 2015, discussing the impact of GP/FM clerkships on undergraduate medical education<sup>7,8</sup>. Turkeshi and colleagues reviewed quantitative studies around the world, whilst Park and colleagues reviewed quantitative and qualitative studies in the United Kingdom<sup>7,8</sup>. A Japanese quantitative study was reported in 2020<sup>9</sup>, using the evaluation items of the Model Core Curriculum for Medical Education in Japan<sup>9</sup>. However, no studies have been reported that analyzed qualitative data quantitatively. Reflective writing in medical education has been introduced in many medical schools worldwide<sup>10</sup>. Analyzing the reflective writing of medical students may be useful for further understanding the impact of clinical clerkships on medical students. However, qualitative judgment in appraising reflective writing may be confounded by reader bias<sup>11</sup>. Text mining can extract keywords (frequent words) from large samples of reflective writing in an efficient and objective manner. Text mining can also identify relationships between extracted words<sup>12</sup>.

The purpose of the present study was to clarify which aspects of GP/FM clerkships the students deemed to be most valuable and which experiences they felt were particularly useful, using text mining

to analyze reflective writing.

## Materials and methods

### *Participants and setting*

Throughout the academic year 2018–2019, clinical clerkships accounted for 50 weeks in both the fifth and sixth years at Fukushima Medical University. The GP/FM clerkship is a mandatory placement undertaken by fifth-year students for 5 days. The study subjects were fifth-year students ( $n = 125$ ) in the academic year 2018–2019. The settings were three GP/FM clinics: Hobara Central Clinic and Kitakata Centre for Community and Family Medicine, both located in rural areas; and Hoshi Yokozuka Clinic, which serves an urban population. Family doctors certified by the Japan Primary Care Association work at these clinics and teach medical students. Students were dispatched in groups of 1 to 2 for their GP/FM clerkship.

### *Contents of GP/FM clerkships*

Table 1 shows objectives for the GP/FM clerkship based on the Model Core Curriculum for Medical Education in Japan<sup>9</sup>. Table 2 shows the standard schedule. It consisted of outpatient care and home visits. During outpatient care, the students performed history taking and vital sign measurements of patients, and then observed consultations by family doctors and received feedback on history taking, diagnostic reasoning, and patients' backgrounds. When participating in home visits, the

Table 1. The objectives in GP/FM clerkships based on the Model Core Curriculum for Medical Education in Japan

1	Assemble or follow diagnostic reasoning that emphasizes medical history/physical examination (including cases without diagnosis).
2	Experience a comprehensive approach to health problems (such as interactions of multiple health problems).
3	Have a viewpoint of family and community and participate to the extent possible in medical practice with more consideration for psychological / social background.
4	Experience home medical care.
5	Experience interprofessional work and recognize its importance.
6	Refer to the health, medical, welfare and long-term care systems in the clinical settings.

Table 2. The standard clerkship schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
am	outpatient care				
pm	home visit	outpatient care	home visit	outpatient care	joint-reflection
evening	reflection	reflection	reflection	reflection	reflection

students assisted the family doctors but also interacted with family members and other health professionals such as home-visiting nurses and home helpers. Their daily reflections were facilitated by family doctors on site. Joint reflections were conducted by university faculty via video conference.

#### Data source

On the final day of their GP/FM clerkship, students completed a reflection sheet. We collected free descriptions on the aspects of the GP/FM clerkship that the students deemed to be most valuable and which experiences they felt were particularly useful via this reflection sheet. The actual question in Japanese was as follows:

「実習で特に印象に残ったことおよびそこから得た学びについて自由に記載してください」

#### Statistical analysis

Text mining was used to extract frequent words (nouns) from the students' free descriptions. In the Japanese language, some verbs contain a noun (e.g., the verb 訪問する is a noun 訪問 with the verbalizing suffix する). In the present study, any verbs containing a noun were separated into their noun and verb components. A co-occurrence network map was created to illustrate the relationships between the most frequently occurring words. Co-occurrence refers to how many times high-frequency words appear in the text in proximity to other high-frequency words<sup>12</sup>. This relationship is called an association, which is calculated numerically as a figure between 0 and 1<sup>12,13</sup>. A co-occurrence network map was used to visualize how keywords group together throughout the entire text, with connecting lines marked with numerical values in the map indicating association strength<sup>12</sup>. All analysis was performed using KH Coder 3.0 (<http://khcoder.net/en/index.html>), a free downloadable multilingual text-mining program developed by Koichi Higuchi, Ritsumeikan University, Japan<sup>14</sup>. Analysis was done in Japanese and translated into English for the report. In the process of interpreting the results of text mining along with the co-occurrence network map, it was considered necessary to refer to the original context to determine the validity, so original text and extracted words are listed in the Results section.

#### Ethics approval

Ethics approval was obtained from the Fukushima Medical University Human Research Ethics Committee, approval number #30153.

Table 3. Student baseline characteristics

	Mean (SD) or N (%)
Age (years)	24 (1.9)
Gender	
Males	77 (62)
Females	47 (38)
Training site	
Hobara Central Clinic	42 (34)
Hoshi Yokozuka Clinic	39 (31)
Kitakata Centre for Community and Family Medicine	43 (35)
Actual learning days	
5	107 (86)
4.5	5 (4)
4	12 (10)

Table 4. List of frequent words

Extracted word	No. of times used
Patient (患者)	192
Home-visit (訪問)	75
Medical practice (診療)	71
Medical care (医療)	51
Family (家族)	47
Impression (印象)	41
Disease (疾患)	38
History taking (問診)	38
Person (人)	29
Home (家庭)	26
Nursing (看護)	26
Teacher (先生)	26
I (自分)	24
Doctor (医師)	23
Care (ケア)	21
Hospital (病院)	21
Illness (病気)	21
Life (生活)	20
Community (地域)	20
Outpatient (外来)	19
Clerkship (実習)	19
Symptoms (症状)	19

## Results

124 students participated in the study; their baseline characteristics are shown in Table 3. The total number of sentences extracted from their free reflections was 321 and the total number of all words, including verbs and other parts of speech, was 10,627. The average number of words written by one student was 137.5 (SD 72.2) and the average

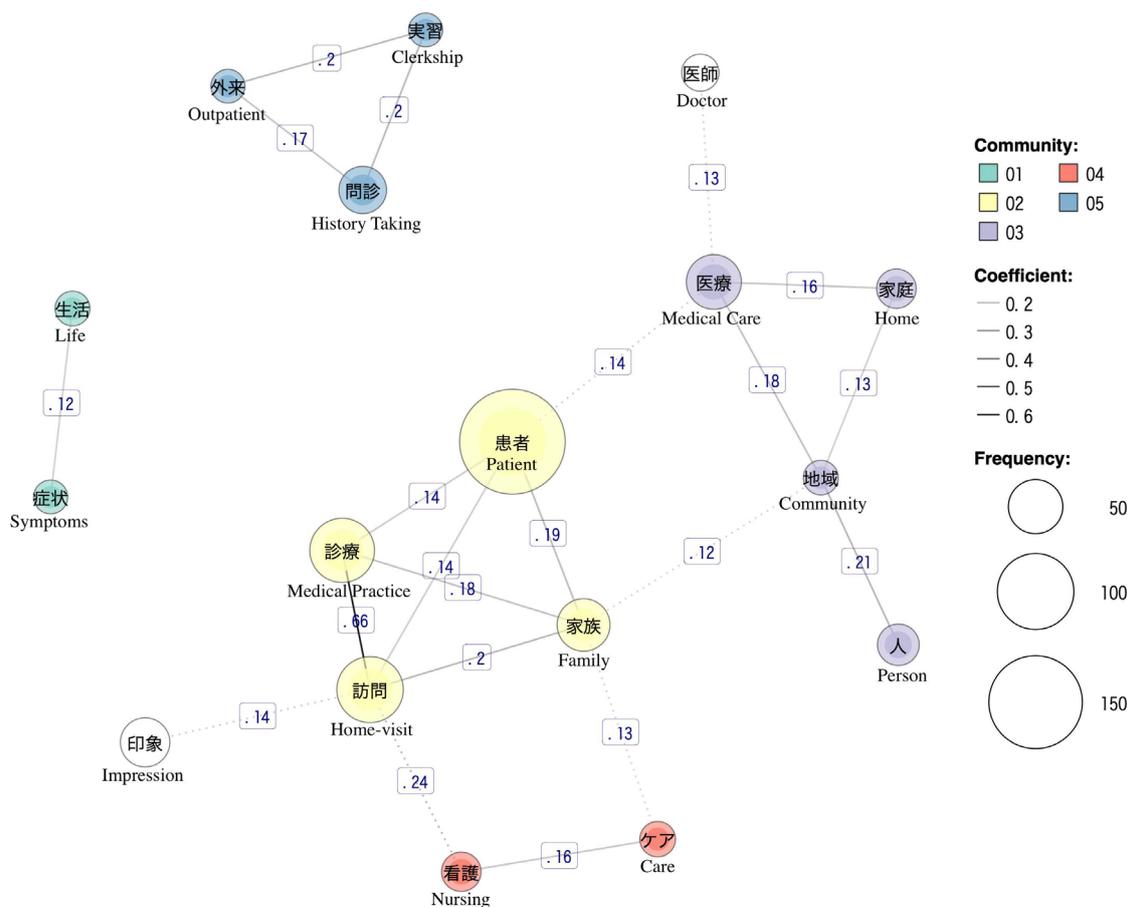


Fig. 1. The co-occurrence network map between each frequent word.

A community is a “part that is relatively strongly connected to each other.” The KH coder automatically detects the community, groups it, and shows the results in different colors. Words that do not form groups with other words are shown in white. Words in the same community are connected with solid lines, while words in different communities are connected with dashed lines. The number on the line is the Jaccard coefficient. This coefficient is calculated between 0 and 1, and the closer it is to 1, the stronger the relationship.

number of sentences was 2.5 (SD 1.1). Table 4 shows the top 20 most frequent words. The top five frequently occurring words were *patient*, *home-visit*, *medical practice*, *medical care*, and *family*. Figure 1 shows the co-occurrence network map linking each frequent word. The strongest co-occurrence relationship was recognized between *home-visit* and *medical practice* (Jaccard coefficient 0.66). A co-occurrence relationship was also recognized between *home-visit* and *family* (Jaccard coefficient 0.2). A translation of typical sentences, including extracted words, is shown in Table 5.

## Discussion

Amongst the top 20 most frequent words, *home-visit*, *family*, *history taking*, *home*, *nursing*, *life*, *community*, and *outpatient* were considered the words indicative of specific meanings. Other words

were considered too general to reveal useful data. *Home-visit* was the most frequent word except for *patient*, and it appears frequently in the description of home visit (see typical sentences : A, B, C and D in Table 5). In a previous study conducted among the same participants as the present study, home visit was the item with the highest self-evaluation score at the end of the GP/FM clerkship<sup>6</sup>). In this respect, the results of the student self-evaluation and the reflective writing are in agreement. *Family*, *home*, and *life* appear frequently in the description of the patient’s psychological / social background (see typical sentences : A, B and C in Table 5). *Nursing* and *community* appear frequently in the description of team-based health care (see typical sentences : C and D in Table 5). In the previous study, it was suggested that psychological/social background and team-based health care are difficult to learn during the clerkships at teaching hospi-

Table 5. Translation of typical sentences containing extracted words

sentences	
A	I felt the necessity of care for the family as well as the patient at home-visit medical practice. (訪問診療では患者さんのケアだけでなくその家族へのケアの必要性も感じた。)
B	I accompanied their family doctor to home-visit medical practice. I felt that the characteristics of each family were strong. Each home had different needs and wants. Meanwhile, the appearance of the family doctor who consulted with each family was different from that of the specialist doctor seen at the university hospital. It was fresh. (訪問診療を実際に同行して、その家族ごとの特徴が色濃く出ていて、それぞれの家庭ごとに困っていることや、求めているものも違うなかで、相談に乗ったりしているのが大学などの病院で見ている医師の姿とはまた違って新鮮でした。)
C	When I attended to patients and their families in home-visit medical practice and home-visit nursing, I felt that teamwork is indispensable in the care of not only the patient's illness, but also all aspects of life. I also better understood doctors' roles as part of the team. (訪問診療、訪問看護に参加する中で、患者さんやその家族に接して疾患だけでなくその生活全体をケアするためにはチーム医療が不可欠になっており、医師はそのチームの一員であるということを感じた。)
D	I thought it was very convenient to have a clinic, a home-visit nursing station, and a home-based long-term care office in one place to care for the same patient, and even if it is not, to have a network that can cooperate in the community. (1つの場所にクリニックと訪問看護ステーション、居宅の介護事務所が存在しているのは同じ患者さんをケアするのに非常に便利だと思ったし、そうでなくても、地域で連携できるネットワークができているのが魅力的だと思った。)
E	The actual process of taking history and vital signs at the outpatient clinic, giving a differential diagnosis of my own, and reviewing it with doctors, was a great learning experience. I had a fulfilling clerkship. (外来で実際にバイタルサインをとったり、問診をとったりして、自分なりの鑑別診断をあげ、それを先生方と反省させていただくという一連の過程がとても勉強になり、充実した実習でした。)

tals<sup>6)</sup>; therefore, we considered it important that medical students were able to learn such skills and valued the GP/FM clerkship experience. *History taking* and *outpatient* appear frequently in the description of active participation in outpatient care (see typical sentences: E in Table 5). A systematic review in the UK reported the benefits of GP/FM clerkships, including deeper exploration of psychosocial factors and social determinants of health, exposure to multidisciplinary learning skills, and increased feedback on history taking and physical examinations compared to that experienced in hospitals<sup>9)</sup>. Therefore, we find that our results, obtained by the text mining of students' reflective writing, are consistent with the findings obtained by conventional methods.

In the co-occurrence network map, the strongest co-occurrence relationship was found between *home-visit* and *medical practice*, because the expression *home-visit medical practice* (訪問診療) was often used (see typical sentences: A, B and C in Table 5). It is noteworthy that a co-occurrence relationship was recognized between *home-visit* and *family*. By referring to the students' answers, it emerges that medical students may learn the necessity of care for patients' families, as well as the patients themselves, in a home care setting (see typical sentences: A, B and C in Table 5). It is possible that students learned the importance of responding to the different needs of each family and

caring for all aspects of life through multidisciplinary collaboration, in a home care setting. A study at another university in Japan reported that medical students learn through home care practice that home care can also reduce the anxiety and burden of patients' families<sup>15)</sup>.

The current study has some limitations that should be addressed. First, it was based at a single educational institution. However, it is noteworthy that the data were obtained from three different GP/FM clinics located in urban and rural areas. Second, because the text data are student-reported outcomes, there might have been some self-reporting bias. It is possible that the students made positive statements out of gratitude and consideration for the family doctors they interacted with. Third, reflective writing was used to explore the impact of GP/FM clerkships on medical students in the present study, but there is insufficient evidence to use reflective writing as an assessment tool<sup>16)</sup>. As a future improvement based on the second and third limitations, if students are guaranteed that the doctors they interact with will be masked from their reflective answers, and if they are anonymously and freely written, this study design may be an effective tool in obtaining answers as honest as possible. Fourth, as the exposure to GP/FM was only for 5 days, it is unclear whether the impact is sustainable. Fifth, we were unable to measure the average number of outpatients or home care patients whom a single medical student

encountered in the morning or afternoon. The volume of encounters may have affected the impact of the students' reflections.

### Conclusions

Data suggest that medical students may learn the necessity of care for the family as well as the patient in a home care setting. Using text mining to analyze student reflective writing may be useful for further understanding the impact of clinical clerkships on medical students.

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### Conflicts of interest disclosure

The authors declare no conflicts of interest.

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