

Practical training reduces aspiration-linked gaps in pressure ulcer education for pharmacy students

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SUMMARY: Expectations for pharmacists' contribution and involvement in pressure ulcer pharmacotherapy are growing. This study aimed to not only clarify the effects of incorporating practical training on the use of topical medications into clinical preparatory education but also examine the relationship between students' aspiration—or lack thereof—to pursue a career as a pharmacist. The percentage of positive responses to the questionnaire survey on knowledge, skills, and attitudes toward pressure ulcer treatment was significantly higher after the lecture than before and highest after the practical training. In addition, students who aspired to become pharmacists tended to provide a higher percentage of positive responses after the lecture. However, the gap between aspiring and non-aspiring pharmacists tended to narrow after practical training. These results suggest that incorporating practical training on pressure ulcer treatment into lectures improves students' knowledge, skills, and attitudes toward its treatment. Including practical training in pressure ulcer education may compensate for the difference in the educational effect of lectures between students who aspire to become pharmacists and those who do not, thereby improving the educational effect for the latter.

Keywords: pressure ulcer, pharmaceutical education, practical training, career path, medical simulator

1. Introduction

Pressure ulcers, also known as decubitus ulcers, are a global concern in the therapeutic care of patients, as they have been associated with increased mortality rates in elderly patients (1,2). In 2009, the Japanese Society of Pressure Ulcers defines pressure ulcers as irreversible hemorrhagic injuries that appear when external force is applied to the body and blood flow in soft tissues between bones and the skin surface is continuously reduced or stopped. Pressure ulcers are a common complication of immobility among older adult patients (3), who are bedridden for long periods of time, and once they develop, they are known to be refractory. The number of patients with bedsores is expected to increase in Japan's super-aging society, both in hospitals and at home, highlighting the urgent need to address this issue. In fact, data from the Washington State Department of Health revealed that hospitalized patients with pressure ulcers have an average increase of 10.8 days in their length of stay (4). Although topical drugs have been commonly used in the topical treatment

of bedsores, the Furuta Method, which involves drug selection based on the characteristics of the base agent, is also widely used (5). After Furuta *et al.* reported that pharmacists' participation in bed sore treatment is effective in not only shortening the duration of treatment but also reducing medical costs, expectations for the contribution of pharmacists in bed sore treatment have been high (6).

In 2014, the Ministry of Health, Labour and Welfare (MHLW) issued the "Handling of Practical Guidance on the Use of Medicines," allowing pharmacists to impart practical guidance on the application or injection of dispensed topical drugs without medical judgment or skill. In addition, in the 2022 revision of medical service fees, descriptions of pharmacological management and collaboration with pharmacists were added to the criteria for bed sore control, which is stipulated as a requirement for basic inpatient fees. Furthermore, the "Action Plan for Pharmacists to Play an Active Role in the Community" issued by MHLW in 2022 calls for the interdisciplinary promotion of measures for bedsores, including practical guidance by pharmacists

on how to apply topical medicines. The incidence and prevalence of pressure ulcers can be reduced through team care involving management by pharmacists (7). Thus, there exists a growing need for pharmacists to participate in bed sore treatment in Japan. However, active participation in pressure ulcer treatment through practical instruction in topical medications is not high. Currently, the Japanese Society of Pressure Ulcers and other organizations are imparting practical training for pharmacists using a pressure ulcer simulator to improve their skills in teaching topical medication. However, to increase the number of pharmacists engaged in bed sore treatment, approaches from pharmacy education are also deemed necessary.

In Japan, a six-year educational program has been implemented in pharmacy universities for pharmacist training. Pre-clinical training for pharmacist practice is imparted in the fourth year within the university setting and, in the fifth year, students undergo pharmacy experiential training in community pharmacies and hospitals, interacting with actual patients under the supervision of licensed pharmacists. The Model Core Curriculum for Pharmaceutical Education, revised in 2013 and 2022 does not list bed sores as a required component of pre-clinical training for pharmacist practice, although they are a required component of pharmacy experiential training. Therefore, learning about bed sores in a practical training format in addition to lectures at universities can be expected to be effective. Pressure ulcer simulators are widely used in practical training for pharmacists engaged in pressure ulcer treatment. However, the educational effect of using a similar simulator for the practical training of pharmacy students without practical experience is unknown. At the Faculty of Pharmacy, Keio University, approximately 40% of graduates are employed as pharmacists in hospitals and community pharmacies. While they are likely to be involved in pressure ulcer treatment as pharmacists, in other career paths, opportunities for involvement are almost nonexistent. A study on the motivational factors involved in nursing students' practical training revealed that acquiring the skills necessary to become a nurse was also a motivational factor (8). In pressure ulcer education, the aspiration, or lack thereof, to become a pharmacist may influence students' motivation to learn and the effectiveness of education. However, these details are unexplored.

In this study, we administered a questionnaire survey to clarify the educational effects of including a practical training course on the practical guidance of topical medication using a pressure ulcer simulator after the conventional lecture as part of the clinical preparatory education for bed sores for fourth-year pharmacy students. We also examined the relationship between the educational effects and whether students want to become pharmacists as a future career path.

2. Materials and Methods

2.1. Subjects and survey methods

A 90-minute lecture on pressure ulcers was given to 138 fourth-year students from the Department of Pharmacy, Faculty of Pharmaceutical Sciences (6-year course), Keio University, on April 24, 2024, in accordance with the syllabus for the 2024 academic year. The students were divided into four groups, undergoing a practical training session on pressure ulcers, which lasted 210 minutes (comprising 90 minutes of classroom lecture and 120 minutes of practical training) on one of the four days from May 20 to 23, 2024. During the practical training, students learned how to teach topical application of drugs in accordance with the Furuta Method using a pressure ulcer simulator (Japan Sleeve Scientific Co., Ltd., Niigata, Japan), which was loaned, free of charge, by Kaken Pharma Co. Students who attended the lectures and practical training were surveyed three times – before, after the lecture, and after the practical training – using a self-administered Google Form. To avoid absenteeism, the pre- and post-lecture surveys were conducted 15 minutes before and 15 minutes after the lecture, respectively. As no student was absent during the practical training, the deadline for responses after the practical training was the day after the training was completed (May 24, 2024).

2.2. Survey items

The questionnaire comprised 9 questions (Supplementary Figure S1, <https://www.ddtjournal.com/supplementaldata/254>). Questions 1–5 sought to determine students' knowledge of pressure ulcers; questions 6–8, their skills and attitudes toward pressure ulcer treatment; and question 9, their intention to pursue a career as a licensed pharmacist in the future. The post-lecture and post-practice questionnaires included a section for post-lecture comments (question 10). Questions 1–8 were five-choice questions rated on a 4-point Likert scale, with "not sure" responses being excluded.

2.3. Data analysis

The most positive responses (know/think/imagine) on the 4-point Likert scale were analyzed. The relationship between educational effectiveness and aspiration to become a pharmacist was analyzed by dichotomizing the highest rating on the scale and the rest of the responses. Simple and cross-tabulations were conducted using Microsoft® Excel® 365 MSO (16.0.18025.20160). Kruskal-Wallis tests and Mann-Whitney *U*-tests were conducted at a significance level of 0.05, using IBM® SPSS® Statistics Version 29.0.0.0 (241) (IBM Japan, Tokyo, Japan).

2.4. Ethical considerations

This study was planned in compliance with the "Ethical Guidelines for Research of the Japanese Society for Medical Education" (effective July 26, 2012) and approved by the Research Ethics Committee for Human Subjects, Faculty of Pharmaceutical Sciences, Keio University (approval number: 240222-1).

3. Results

3.1. Effectiveness of lectures and practical training on pressure ulcers

Of the 138 students enrolled in the course, 74 (53.6%), 75 (54.3%), and 100 (72.5%) responded to the pre-lecture, post-lecture, and post-practice questionnaires, respectively (response rate in parentheses).

Figure 1 depicts the results of students' knowledge (questions 1–5) related to pressure ulcer treatment in the three surveys. For all items, the percentage of positive responses tended to increase in the following order: pre-lecture, post-lecture, and post-practice. Due to the exclusion of "not sure" responses from the statistical

analysis, the sample size (n) varied for each response. When analyzing the distribution of responses for knowledge, significant differences were observed after the lecture and after the practical training compared to before the lecture for all questions (Kruskal-Wallis test, $p < 0.01$). As a result of the lecture and practical training, the number of students selecting positive responses increased for not only the attitude- and skill-related categories (questions 6–8) but also other categories (Figure 2). When analyzing the distribution of responses for skills and attitudes, significant differences were observed in questions 6 and 7. The responses after the lecture and after the practical training differed significantly from those before the lecture ($p < 0.01$). In question 8, a significant difference was observed between the responses after the practical training and those before the lecture ($p < 0.05$).

3.2. Association between aspiration to become a pharmacist and educational effectiveness

Figure 3 depicts the results of the three questionnaires in terms of students' intention to work as pharmacists in the future. In the pre-lecture survey, 23% of students

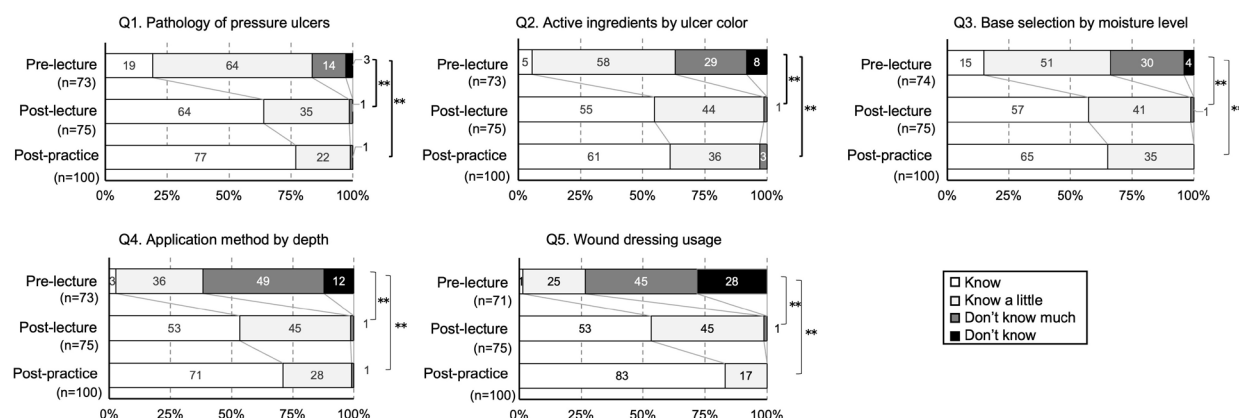


Figure 1. Student questionnaire on knowledge of pressure ulcer treatment. Comparison of the percentages for each questionnaire item (questions 1–5) at pre-lecture, post-lecture, and post-practice. The items are related to knowledge of pressure ulcer treatment. Statistical analysis was performed using the Kruskal–Wallis test. **: $p < 0.01$.

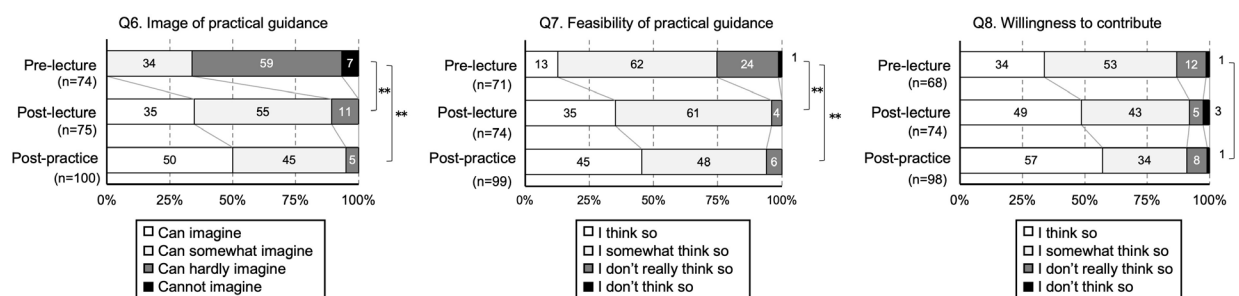


Figure 2. Student questionnaire on skills and attitudes of pressure ulcer treatment. Comparison of the percentages for each questionnaire item (questions 6–8) at pre-lecture, post-lecture, and post-practice. The items are related to skills in and attitudes towards pressure ulcer treatment. Statistical analysis was performed using the Kruskal–Wallis test. *: $p < 0.05$, **: $p < 0.01$.

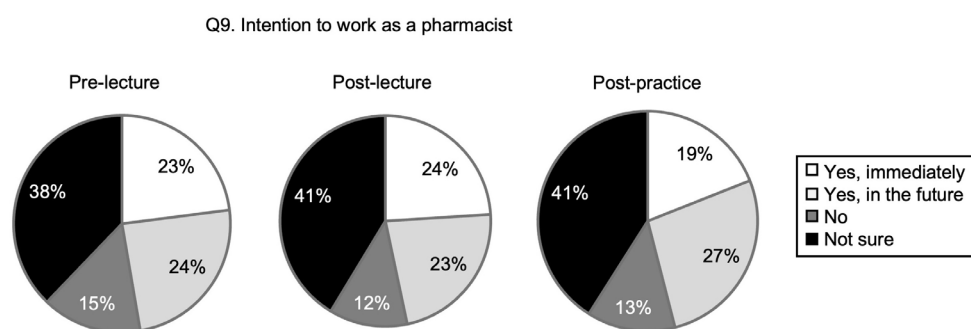


Figure 3. Student intention to work as a pharmacist in the future. The pie charts shows the results of responses to question 9, which asked whether students intended to pursue a career using their pharmacist license in the future. Responses were collected at pre-lecture, post-lecture, and post-practice. Students who answered "Yes" were classified as those aspiring to become pharmacists.

answered that they intended to work as a pharmacist immediately after graduation, 24% intended to change jobs in the future and work as a pharmacist someday, 15% did not intend to work as a pharmacist, and 38% reported they did not know at present. The percentage of students who intended to work as pharmacists, including those who wished to begin working immediately and those who planned to do so in the future, was 47%. Similar trends were observed in the post-lecture and post-practice questionnaires.

Table 1 depicts the number and percentage of positive responses for knowledge (questions 1–5) and skills and attitudes (questions 6–8) related to pressure ulcer treatment in the three surveys. Before the lecture, the percentage of positive responses was low for knowledge, skills, and attitudes, with many items below 20%. After the lecture, the percentage of positive responses for all items increased, although the percentage of positive responses for skills and attitudes remained lower than that for knowledge. After the practical training, the percentage of positive responses for skills and attitudes reached almost 50%. In the pre-lecture questionnaire, the percentage of positive responses was low for all questions, with no significant difference observed depending on whether the students wanted to become pharmacists. In the post-lecture questionnaire, the percentage of positive responses increased for all questions—especially questions 1, 2, and 4—with the percentage of positive responses from students who wanted to become pharmacists being significantly higher than that from students who did not want to become pharmacists (Mann-Whitney *U*-test, $p = 0.028$, $p = 0.002$ and $p = 0.014$). In the post-practice questionnaire, the percentage of positive responses from students who wanted to become pharmacists was significantly higher than that of students who did not want to become pharmacists in questions 2 and 3 ($p = 0.043$ and $p = 0.033$).

In addition, to confirm the relationship between the effects on knowledge (questions 1–5) and skills/attitudes (questions 6–8) in pressure ulcer education and the aspiration, or lack thereof, to become a pharmacist,

the difference in positive response rates was calculated. Before the lecture, the mean difference in positive response rates between students who wanted to become pharmacists and those who did not was small (-1.9 ± 1.4 points). However, after the lecture, the difference in positive response rates increased for all questions, with a mean value of 21.5 ± 2.9 points, 10 times higher than that before the lecture. In addition, students who wanted to become pharmacists tended to give more positive responses than those who did not. After the practical training, the differences tended to be smaller than after the lecture in all items, and the mean value of the differences was reduced to 9.4 ± 2.4 points.

4. Discussion

In this study, we investigated the educational effects of including practical training on topical medication using a pressure ulcer simulator in conventional lectures for fourth-year pharmacy students in the Department of Pharmacy.

Before the lecture, the percentage of students who rated their knowledge, skills, and attitudes highly was low. After the lecture, although this percentage increased, it did not reach the majority. After the practical training, the proportion of students who rated their knowledge, skills, and attitudes highly improved to almost a majority. In addition, the students' aspirations to become pharmacists in the future was also examined in relation to the aforementioned educational effects. Although the difference in positive response rates was small before the lecture, the average difference in positive response rates increased by more than 20 points after the lecture, for students who wanted to become pharmacists compared to those who did not. We, thus, confirmed that the addition of practical training after the lecture increased the positive response rate of the non-pharmacist students and narrowed the above-mentioned difference. With regard to pressure ulcers, understanding the concepts of external forces, the shape of bony prominences, and the mobility of soft tissues is essential (9). However, students who do not aspire to become pharmacists seem to have difficulty

Table 1. Number of positive responses on knowledge, skills, and attitudes in pressure ulcer education by pharmacists' aspirations

Q	Pre-lecture			Post-lecture			Post-practice		
	Pharmacist aspiration		p value	Pharmacist aspiration		p value	Pharmacist aspiration		p value
	Yes, n (%)	No, n (%)		Yes, n (%)	No, n (%)		Yes, n (%)	No, n (%)	
1	6/34 (18)	8/39 (21)	0.758	27/35 (77)	21/40 (53)	0.028*	36/46 (78)	41/54 (2.4)	0.783
2	0/35 (0)	4/38 (11)	0.050*	26/35 (74)	15/40 (38)	0.002**	33/46 (72)	28/54 (52)	0.043*
3	6/35 (17)	5/39 (13)	0.604	24/35 (69)	19/40 (48)	0.067	35/46 (76)	30/54 (56)	0.033*
4	1/35 (2.9)	1/38 (2.6)	0.953	24/35 (69)	16/40 (40)	0.014*	34/46 (74)	37/54 (69)	0.555
5	0/34 (0)	1/37 (2.7)	0.338	22/35 (63)	18/40 (45)	0.125	41/46 (89)	42/54 (78)	0.134
6	0/35 (0)	0/39 (0)	1.000	14/35 (40)	12/40 (30)	0.367	24/46 (52)	26/54 (48)	0.690
7	4/33 (12)	5/38 (13)	0.897	14/34 (41)	12/40 (30)	0.319	22/46 (48)	23/53 (43)	0.660
8	11/34 (32)	12/34 (35)	0.799	21/35 (60)	15/39 (39)	0.066	28/46 (61)	28/52 (54)	0.485

Notes: Q = Question No. Positive response: The most positive response on a 4-point Likert scale (know/think/imagine). *, $p < 0.05$, **, $p < 0.01$ (Mann-Whitney U test). Values = number of positive responses / number of valid responses.

grasping these concepts. Our study results suggest that students may not be deeply engaged until they see and experience these concepts firsthand through a pressure ulcer simulator.

The percentage of positive responses to all items measuring students' knowledge, skills, and attitudes in relation to the educational effects of bed sore treatment tended to increase in the following order: before the lecture, after the lecture, and after the practical training. These results indicate that the addition of practical training – using a bed sore simulator – to a lecture improves students' knowledge, skills, and attitudes (Table 1). Mizokami *et al.* reported that deep pressure ulcers require "wound fixation" (10); however, these concepts are difficult to fully understand through lectures alone. Pressure ulcer simulators are useful for learning practical techniques and observing wound sites. Answers to questions 6 and 7 were significantly better after the lecture than before, while answers to question 8 were significantly better after the practice than before. For question 8, which is related to attitude, 30% of the students responded positively before the lecture. This suggests that although many pharmacy students have low skills in pressure ulcer treatment, their awareness of its treatment before the lecture is high. Although the percentage of positive responses to all items increased from pre- to post-lecture, the percentage of positive responses to skills and attitudes remained at about 30%. By including practical training, the percentage of positive responses for skills and attitudes reached approximately 50%. Thus, while lectures alone are insufficient to enhance pharmacy students' skills and attitudes toward pressure ulcer treatment, practical learning through hands-on training can be expected to have a sufficient educational effect. In the context of medication counseling for topical drugs, reports indicate that community pharmacists provide inadequate patient instructions regarding the application of topical steroids (11). We believe that improving the skills and attitudes of pharmacists through practical training in topical drug application in pharmacy education will raise the level of topical drug instruction among pharmacists in Japan.

Differences in the positive response rates for all items of knowledge, skills, and attitudes after the lecture were observed depending on students' aspiration to become pharmacists. The students who aspired to become pharmacists tended to respond more positively to all items (Table 1). However, including practical training after the lecture tended to reduce the differences in all items of knowledge, skills, and attitudes. Although the questionnaire collection rate in this study was good (exceeding 50% before the lecture), after the lecture and the practical training, the equivalent response rates for each questionnaire could not be confirmed because students' personal information was not obtained due to ethical considerations. However, because the responses regarding students' intention to work as a pharmacist in

the future were the same in all three questionnaires, we do not believe that there exists a major problem with the equivalence of the response groups.

One limitation of this study is that matters concerning students' personal information were not collected due to ethical constraints, making it impossible to examine the educational effects of individual students across questionnaires. Another limitation is that, as the study was conducted on actual pharmacy students in an educational setting, it was not possible to validate the findings through an interventional trial with a control group.

The results of this study suggest that the knowledge, skills, and attitudes of pharmacy students can be improved by providing practical training using a pressure ulcer simulator in addition to lectures. Moreover, the inclusion of practical training to lectures in pressure ulcer education for pharmacy students compensated for differences in the educational effects of lectures depending on whether students wanted to become pharmacists, potentially increasing the educational effects of students who did not want to become pharmacists to the same level as those of students who did at the time of the course.

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