



The impact of a medical drama featuring a hospital pharmacist on the perception of pharmacists among high school students and guardians: A quasi-experimental study[☆]

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ABSTRACT

Background: A pharmacist's work has shifted from non-personal to in-person services; especially in a super-aging society, further collaboration with other professions is needed. Communication has become an essential skill for pharmacists. However, there is limited public awareness about the work of pharmacists, and their perception among high school students is unclear. Medical dramas have been reported as educational tools for students, including their role in influencing the career choices of health professionals.

Objective: This study aimed to evaluate the impact of a TV drama featuring a hospital pharmacist on perceptions of pharmacists among high school students and guardians.

Methods: An online survey involving 300 high school students and 300 guardians with their own high school children was conducted before the drama aired, and a post-survey conducted after it finished airing. Regular viewing was defined as exposure in this study. A difference-in-differences approach was used to compare the change in perceptions toward pharmacists' work, required knowledge, aptitude, and communication needs.

Results: Comparing before and after they viewed the drama, high school students had significant differences in their perceptions of pharmacist duties such as "one-dose package dispensing" and "health consultation other than medicine," while guardians had different perceptions of "collaboration with health care professionals" and "information sharing about medication therapy." Regarding pharmacist aptitude, only guardians showed significant differences in their perceptions of skills such as "precision," "cooperativeness," and "decisiveness." There were no significant differences in the perceived level of communication required for pharmacists.

Conclusions: The results indicated that the portrayal of the pharmacist in the drama may have had some impact on high school students and guardians and was considered useful as an opportunity to learn about pharmacists. However, it was suggested that pharmacists should make the public understand that their work requires real-world communication skills.

1. Introduction

In recent years, the work of pharmacists has shifted from non-personal to in-person services, and they are expected to play a different role than in the past. Japan is a super-aging society, and by 2025, the demand for medical care and long-term care will increase as the baby boomer generation turns 75 years old. The construction of the Community-based Integrated Care System (CICS) is being promoted to enable the elderly to live as they choose in their communities, even if they require long-term care. This is a system in which medical care, nursing care, prevention, housing, and daily life support are provided in a comprehensive manner in the community.¹ In 2015, the Ministry of Health, Labour and Welfare in

Japan proposed "Vision of Pharmacies for Patients," which proposes new roles for pharmacists, moving from dispensing-centered practice to patient-centered health care, including increased involvement with patients as a family pharmacist, development of team medicine at medical institutions, and responsibility as a member of the professions in the CICS.²

To fulfill the role of providing safe and effective medication therapy to patients in medical institutions, nursing care facilities, other related organizations, and/or at homes seamlessly, community pharmacists need to collaborate with other medical professionals such as physicians, nurses, caregivers, dietitians, and pharmacists in other institutions, such as hospital pharmacists. Hospital pharmacists are expected to play an active role in the inpatient nutrition support team³ in collaboration with physicians,

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nurses, and dietitians, as well as in pre-examination interviews with outpatients.^{4,5} The responsibilities of hospital pharmacists also include visiting patients who have difficulty commuting to the hospital for medication counseling,⁶ educating outpatients in cardiac rehabilitation to continue medication treatment,⁷ and establishing a cooperative system for disaster medicine in affected areas.⁸ Effective communication is essential for pharmacists to provide consultation to patients and to collaborate with various professions. In other words, pharmacists have become a profession that requires communication skills, unlike in the past, when the work was focused mainly on dispensing drugs. However, in a nationwide survey, “Fact-Finding Survey for the Realization of the *Vision of Pharmacies for Patient*” in 2016, >90% of 2025 patients who responded perceived pharmacies as places where they received medicines prescribed by doctors, and those who thought they could consult with pharmacists about matters other than medicine were <20%.⁹ A public opinion survey in 2020 answered by 1944 individuals aged 18 years old and more (response rate 64.8%) on the use of pharmacies reported that the proportion of people who would consult their eating and exercise habits with a pharmacist at a pharmacy was <10%.¹⁰ It is possible that the public does not properly understand the work of pharmacists.

High school students are generally at the age at which they decide on the course of their future education, particularly in the case of medical careers, including pharmacists, because the students must choose and enroll in a university that will qualify them to sit for the national examinations. It is desirable for students who want to be pharmacists to have some knowledge about the professional tasks that are involved and to recognize that good communication skills are required for the profession. It has been reported, however, that high school students rarely considered pharmacists as a consulting partner when using medicines.¹¹ This would indicate that they had poor awareness of the roles of pharmacists. It is predicted that high school students have generally not had much opportunity to learn about the duties of pharmacists in depth, and it is unclear whether Japanese high school students are aware of the changes in the role of pharmacists in recent years. Similar to the students and the wider public, the guardians of high school students may have some misconceptions or knowledge gaps regarding the role of modern pharmacists.

It has been reported that family members play a significant role in the career choices of high school students¹² and that role models in medical dramas influence the career choices of medical students.¹³ Medical dramas have been discussed and evaluated from various perspectives, including the impact of drama viewing on health-related outcomes^{14,15} and their potential use as an educational tool for medical and nursing students, among others.¹⁶ In this context, the first medical TV drama featuring a hospital pharmacist was broadcast in Japan in 2020. The drama, titled “*Unsung Cinderella ~prescription of hospital pharmacist~*,” was dramatized from the original *manga* based on medical topics provided by a pharmacist and its production was supervised by medical professionals. Considering the history of this producing, it is possible that the audience gained an understanding of the role of pharmacists through the broadcast of the drama. In addition, it was expected that high school students who are not typically interested in medical care would also watch the drama because it featured popular actors.

Therefore, it was hypothesized that regular viewing of the drama would influence the perception of pharmacists and increase awareness of the importance of knowledge and communication skills in pharmacy practice among high school students. This study aimed to evaluate the impact of the TV drama on the perception and awareness of hospital pharmacists among high school students and guardians living with their own high school children using quasi-experimental designs.

2. Methods

2.1. The storyline of the medical drama

The medical TV drama “*Unsung Cinderella ~prescription of hospital pharmacist~*” is a human drama focusing on hospital pharmacists that was based on the medical *manga* series “*Unsung Cinderella Hospital Pharmacist Aoi Midori*” (written by Mamare Arai, original medical idea by Hiromitsu

Tomino). The title “*Unsung*” comes from the phrase “unsung heroes,” which refers to pharmacists being less visible in clinical settings than other healthcare professionals. The message conveyed by the drama every week was that pharmacists are the “last bastion” (last line of defense), the last healthcare professionals to check medicines before handing them to patients, and that it is their responsibility to protect the irreplaceable daily lives of their patients for years to come. The 11 independent episodes depicted scenes of dispensing medications in a hospital setting, ward activities, medical treatment of patients with type 1 diabetes, receiving end-of-life home treatment for cancer, administering medication to children, drug interactions, adherence to medications, etc. The drama also showed that pharmacists communicated with various hospitalized patients and their families and collaborated with colleagues and other medical professionals. Because of the wide range of work that pharmacists are involved in, the drama was considered suitable for getting an overview of the work that pharmacists do.

2.2. Study design

A quasi-experimental design was used to evaluate the impact of the TV drama on the perception of pharmacists. Online surveys were conducted before and after the drama was aired, and the change in results between the exposure and non-exposure groups was compared.

2.3. Research subjects and survey

Online surveys before (pre-survey) and after (post-survey) the airing of the drama were conducted by an online survey company (Rakuten Insight, Inc. Tokyo, Japan), which has access to approximately 2 million registered members in all the prefectures in Japan. Invitations to participate in a survey were sent to high school students (ages 15 to 18) and adults between the ages of 30 and 59 with high school-aged children (hereafter referred to as guardians) who were registered members of the survey company, and a screening survey was conducted. Data collected from the students included information about their school year and sex; guardians were asked if they were living with a child of high school age and if they held a medical qualification. The guardians who had pharmacist qualifications were excluded. A total of 300 high school students and 300 guardians (150 of each sex) were recruited for the pre-survey that was conducted from July 10–13, 2020. The medical drama aired between July 16 and September 24, 2020. After that, a post-survey invitation was sent by the survey company to each of the 300 individuals who responded to the pre-survey, resulting in 250 high school students and 300 guardians responding to the post-survey between September 25 and October 22, 2020. The sample size was set such that even if some students dropped out of the second survey, the two groups would be comparable, as the number of high school students registered at the research company conducting the survey was limited and it was not possible to predict viewer ratings for the drama. The same number of guardians was assumed.

2.4. Exposure

The exposure was defined as regular viewing of the medical drama.¹⁴ In the post-survey, the frequency of watching the drama was asked using the self-reported question “How often did you watch the TV drama during the broadcast?” with the answer options being “every time,” “sometimes,” “only once,” “none,” and “I didn’t know that TV program.” The exposed group (those who watched it regularly) included the respondents who answered “every time” and “sometimes,” and the non-exposed group (those who did not watch it) included those who answered “none” and “I didn’t know that TV program.” Those who responded “only once” were excluded from this study.

2.5. Outcomes of the questionnaire

(1) Pharmacist work: A total of 20 items were listed, and the respondents were questioned about their understanding of the work of pharmacists. Table 1 presents the statements and summary. (2) Knowledge

Table 1
Summary of pharmacists' work items and statements in the questionnaire.

Item No.	Summary	Statements about pharmacists' work in questionnaire
1	Dispense medications	Dispense medications according to the prescription
2	Audit prescriptions	Audit that the prescribed medication and dosage are appropriate for the patient
3	Check the drug interactions	Check the drug-drug interactions which could cause side effects or change the effectiveness of the drug
4	Check the concomitant medications	Check the concomitant medications prescribed by other doctors using the personal medication notebook
5	One-Dose Package dispensing	When several medications are prescribed to take at a time, if necessary, taking them out of each sheet and dispensing them in a One-Dose package for the patient to take easily
6	Aseptic dispensing	Prepare injections and ophthalmic solutions aseptically (bacteria-free) for patients according to prescriptions
7	Advice to prevent doping	Advise athletes to avoid inadvertently taking medications that contain ingredients that are banned in athletic competitions
8	Label drug information in medication notebook	Label the information of prescribed medications in the medication notebook
9	Deliver medicines to patients' homes or nursing homes	Deliver medicines to the homes or nursing homes of patients who cannot go to the hospital
10	Relief works during the disaster	Relief work like medication management for the residents in the affected area during earthquakes or natural disaster
11	Medication instruction	Explain the medication to patients and instruct them to take it appropriately
12	Check side effects	Ask patients if they have experienced any side effects from the medication
13	Organize remaining medication	Check and organize any forgotten or remaining medication at home
14	Health consultation other than medicine	Listen to the patient and give advice on health and diet other than medication
15	Telephone follow-up to patients	If necessary, call patients at home to check if they are taking the medication correctly and if there are experiencing any side effects
16	Keep record of patient's medication	Keep records of medications taken by patients
17	Collaboration with health care professionals	Discuss the patient's treatment and medication plan with doctors, nurses, dietitians, or other health care professional
18	Suggest appropriate medication for the patient	Suggest to the physician if the type or dosage of the patient's medication (prescribed or being taken) is not appropriate for the patient
19	Information sharing about medication therapy	Report to physicians or nurses any necessary information for the patients' medication treatment (e.g., side effects, remaining medications, difficulty in swallowing/use, inappropriate timing for taking, etc.)
20	Home visiting service	Visit the patient at home to manage the medicine and check the side effects and physical condition

required of pharmacists: 10 types of knowledge were shown, and the respondents were asked to indicate on a 5-point scale (1 = not necessary; 5 = very necessary) the degree to which they thought hospital pharmacists needed the knowledge. (3) Occupational aptitude for pharmacists: 10 items were shown, and the respondents were asked to indicate on a 5-point scale (1 = not important; 5 = very important) the degree to which they thought they were important as aptitudes for hospital pharmacists. (4) Need for communication by pharmacists: 10 different types of medical counterparts for pharmacists were presented, and the respondents were asked about the communication needs for each counterpart on an 11-point scale ranging from 0 (not necessary) to 10 (very necessary). The outcomes for each category are listed in the results tables (Tables 4–6, respectively). The above questions were asked for all subjects without reference to the drama. Respondents were then asked how often they watched the medical drama “*Unsung Cinderella*,” and those who indicated that they had watched the drama were asked, “Has your impression of pharmacists changed compared to before watching the drama?” and they responded according to a four-point Likert scale: changed, slightly changed, not much changed, and not changed. These four sections were selected based on what a pharmacy faculty believed high school students should know when choosing a career as a pharmacist. To ensure comprehensive coverage of the role of pharmacists in Japan, the survey items were developed after a thorough discussion by the faculty members of the laboratory in charge of the education for pharmacy students and clinical pharmacists. All faculty members were qualified pharmacists, with some having experience working in hospital or community pharmacies; thus, they were equipped to accurately represent the role of a pharmacist in Japan.¹⁷

2.6. Covariates

Individual characteristics were assessed by a self-reported questionnaire during the pre-survey. Sex, age categories (school grade for the high school students; three age groups for the guardians), having a medical worker in the family (yes or no), and experience of conversation with pharmacists (yes or no) were obtained from the data. Having read the original manga

(yes or no) and having interest in a career as a pharmacist (for the students, yes or no) were recategorized into two groups from four answer options. Having a medical qualification (yes or no) was used as the screening test for guardians.

2.7. Statistical analyses

The awareness of the work of hospital pharmacists was described as a percentage, and McNemar tests were used to evaluate the change in awareness from before the drama to after in the exposed and unexposed groups. Regarding other outcomes, the level of response was scored, and the average score was presented. The Wilcoxon signed-rank test was used to compare pre- and post-survey results in each group.

A difference-in-differences (DID) analysis¹⁸ was conducted to compare the changes in outcomes with the timeline between the exposed and the unexposed groups to evaluate the impact of the drama in a quasi-experimental design. To use the DID design, no parallel trends were assumed; however, since no data to evaluate the parallel trend assumption were available, logistic regression and multivariate regression analyses were conducted with adjustments for variables that might affect the two groups differently. The covariates at the baseline were used. The association between regular viewing of the drama and outcomes was estimated by examining the interaction terms for time and exposed and unexposed variables. If the interaction was statistically significant, it was interpreted as significantly different.¹⁸ All analyses were performed using Stata version 15 (StataCorp LLC College Station, TX, USA). The level of statistical significance was set at $p < 0.05$ (two-tailed).

2.8. Ethics approval

It was indicated online in advance, that it is an anonymous survey, that participation in this study is voluntary, and that they would not be disadvantaged if they stopped during the survey. Only those who could agree were asked to start responding. This study was approved by the Research Ethics Review Committee of the Faculty of Pharmaceutical Sciences, The University of Tokyo (No. 2-2).

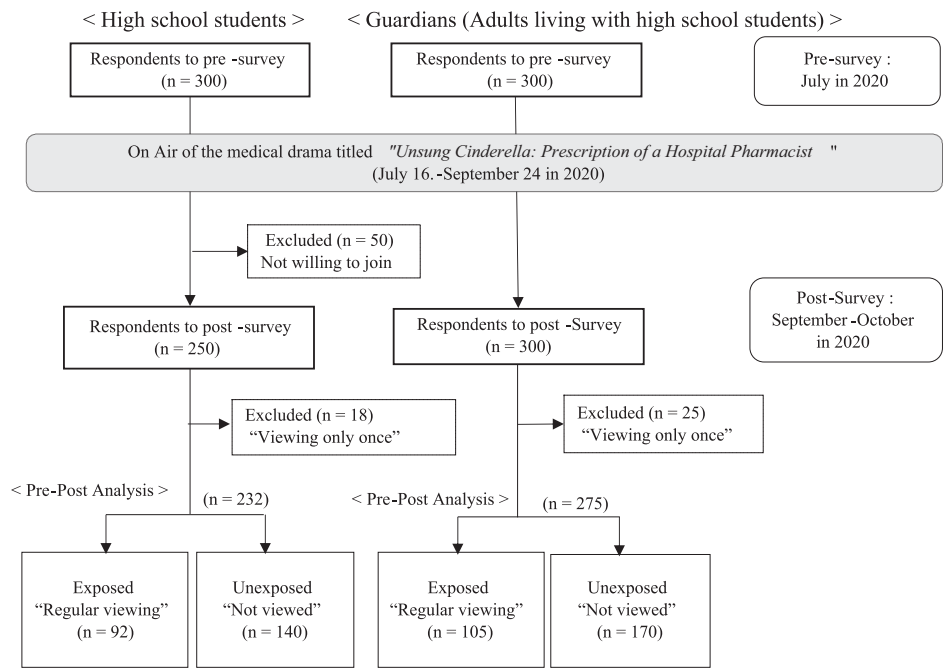


Fig. 1. Flow chart for the study.

3. Results

The flow chart of this study is displayed in Fig. 1. A total of 232 high school students and 275 guardians were included in the analysis after those who answered that they watched the drama only once were excluded.

3.1. Participant characteristics

Baseline demographics are shown for the exposed and unexposed groups separately (Table 2). Baseline results for each of the 300 participants in the pre-survey are presented in another paper.¹⁹ Both the high school students and guardians had significantly more women than men in the regular

Table 2
Characteristics of the participants at baseline.

	High school students (n = 232)				p-value ^{a)}	Guardians (n = 275)				p-value ^{a)}
	Exposed (n = 92)		Unexposed (n = 140)			Exposed (n = 105)		Unexposed (n = 170)		
	n	(%)	n	(%)		n	(%)	n	(%)	
Sex										
Men	21	22.8	51	36.4	0.028	40	38.1	99	58.2	0.001
Women	71	77.2	89	63.6		65	61.9	71	41.8	
School grade of Students					0.039 ^{b)}					
1 st	9	9.8	5	3.6						
2 nd	37	40.2	45	32.1						
3 rd	46	50.0	90	64.3						
Age of guardians										0.087
35-45						39	37.1	44	25.9	
46-49						36	34.3	59	34.7	
50-59						30	28.6	67	39.4	
Medical qualification										0.86
Yes						8	7.6	14	8.2	
No						97	92.4	156	91.8	
Medical worker in family					0.008					0.46
Yes	27	29.4	21	15.0		19	18.1	25	14.7	
No	65	70.7	119	85.0		86	81.9	145	85.3	
Conversation with pharmacists (baseline)					0.001					0.009
Yes	50	54.4	44	31.4		62	59.1	73	42.9	
No	42	45.7	96	68.6		43	41.0	97	57.1	
Interest in a career as a pharmacist (baseline)					<0.001					
Yes	23	25.0	8	5.7						
No	69	75.0	132	94.3						
Have read the original manga (baseline)					<0.001					1.00 ^{b)}
Yes	24	26.1	8	5.7		5	4.8	8	4.7	
No	68	73.9	132	94.3		100	95.2	162	95.3	

a) chi square test, b) Fisher's exact test.

Table 3
High school students' and guardians' awareness of pharmacists' tasks before and after the broadcast of the drama.

	High school students (n = 232)							Guardians (n = 275)																					
	Exposed (n = 92)			Unexposed (n = 140)			DID	Exposed (n = 105)			Unexposed (n = 170)			DID															
	Pre (%)	Post (%)	P ^{a)}	Pre (%)	Post (%)	P ^{a)}		Pre (%)	Post (%)	P ^{a)}	Pre (%)	Post (%)	P ^{a)}																
															P ^{b)}														
1. Dispense medications	70.7	70.7	1.00	68.6	70.0	0.75	0.87	80.0	82.9	0.47	80.6	78.8	0.64	0.49															
2. Audit prescriptions	72.8	79.3	0.29	76.4	72.9	0.43	0.21	82.9	89.5	0.14	72.9	75.3	0.58	0.35															
3. Check the drug interactions	70.7	79.3	0.16	72.9	70.7	0.65	0.19	84.8	87.6	0.53	81.8	75.9	0.12	0.21															
4. Check the concomitant medications	67.4	76.1	0.19	74.3	67.1	0.10	0.06	76.2	80.0	0.47	67.1	70.0	0.50	0.83															
5. One-Dose Package dispensing	55.4	66.3	0.09	63.6	54.3	0.07	0.03	67.6	73.3	0.33	56.5	66.5	0.02	0.68															
6. Aseptic dispensing	69.6	65.2	0.47	66.4	63.6	0.58	0.85	73.3	77.1	0.51	58.8	69.4	0.03	0.51															
7. Advice to prevent doping	56.5	68.5	0.07	50.7	46.4	0.44	0.08	60.0	55.2	0.42	41.8	45.9	0.39	0.30															
8. Label drug information in medication notebook	54.3	58.7	0.51	58.6	56.4	0.68	0.49	58.1	52.4	0.30	51.2	54.1	0.45	0.32															
9. Deliver medicine to patients' homes or nursing homes	51.1	53.3	0.73	43.6	37.9	0.29	0.40	30.5	36.2	0.29	27.6	31.2	0.42	0.82															
10. Relief works during the disaster	89.1	94.6	0.34	52.1	55.0	0.60	0.37	54.3	52.4	0.75	42.9	45.3	0.61	0.62															
11. Medication instruction	82.6	80.4	0.59	75.0	74.3	0.88	0.82	84.8	87.6	0.56	80.6	75.9	0.21	0.27															
12. Check side effects	71.7	81.5	0.09	71.4	67.1	0.41	0.08	76.2	86.7	0.04	68.8	72.9	0.31	0.24															
13. Organize the remaining medication	55.4	57.6	0.77	41.4	43.6	0.68	1.00	43.8	56.2	0.05 ^{d)}	37.1	41.2	0.34	0.35															
14. Health consultation other than medicine	48.9	65.2	0.03	57.1	52.9	0.42	0.03	57.1	60.0	0.65	38.2	46.5	0.07	0.53															
15. Telephone follow up to patients	51.1	58.7	0.22	53.6	52.1	0.76	0.34	44.8	51.4	0.27	35.9	40.6	0.26	0.85															
16. Keep record of patients' medication	62.0	64.1	0.74	62.1	58.6	0.48	0.53	57.1	67.6	0.08	54.7	52.4	0.59	0.13															
17. Collaboration with healthcare professionals	71.7	81.5	0.09	70.7	70.0	0.87	0.18	62.9	80.0	0.01	64.1	64.7	0.89	0.03															
18. Suggest appropriate medication for the patient	72.8	75.0	0.68	72.1	69.3	0.53	0.55	67.6	82.9	0.01	69.4	70.6	0.78	0.05 ^{e)}															
19. Information sharing about medication therapy	71.7	77.2	0.34	65.0	65.0	1.00	0.50	67.6	83.8	0.002	70.6	68.2	0.57	0.01															
20. Home visiting service	45.7	63.0	0.01	42.1	41.4	0.89	0.06	33.3	45.7	0.02	28.2	25.9	0.58	0.08															

DID: difference-in-differences analysis,

a) McNemar's test.

b) p-value of DID adjusted for sex, school grade, medical worker in family, conversation with pharmacist, original manga, interest in a career as pharmacist.

c) p-value of DID adjusted for sex, age, medical qualification, medical worker in family, conversation with pharmacist, original manga.

d) Values before rounding: 0.047 e) Values before rounding: 0.051.

viewing group (the exposed group). The exposed group were more likely to have had a conversation with a pharmacist at baseline compared to the unexposed group for both the students and the guardians. The exposed students were more likely to have a family member who is a medical professional, be interested in a career as a pharmacist, and have read the original manga.

3.2. Perception of pharmacists' work (see Table 3)

In the pre- and post-viewing comparison, exposed high school students showed a significant increase in two items, while the unexposed group showed no significant difference. Significant differences in DID analysis were found for “one-dose package dispensing” and “health consultation

other than medicine.” Among guardians, six items significantly increased in the exposed group and two items in the unexposed group in the before/after viewing comparison; however, statistically significant differences were found only in “collaboration with health care professionals” and “Information sharing about medication therapy” by DID analysis, which was adjusted for covariates.

3.3. Knowledge required for pharmacists (see Table 4)

For high school students, there were no significant changes before and after watching the drama in either the exposed or unexposed groups, and no significant differences were found by DID analysis. For the guardians, the average score was increased for two items in the exposed group and

Table 4
Comparison of the perception of knowledge required for pharmacists between the exposed and non-exposed groups.

Item of knowledge	High school students (n = 232)							Guardians (n = 250)																					
	Exposed (n = 92)			Unexposed (n = 140)			DID	Exposed (n = 105)			Unexposed (n = 170)			DID															
	Pre	Post	P ^{a)}	Pre	Post	P ^{a)}		Pre	Post	P ^{a)}	Pre	Post	P ^{a)}																
															P ^{b)}														
1. Knowledge of medicine	4.6	4.5	0.31	4.4	4.4	0.29	0.78	4.8	4.9	0.12	4.7	4.5	0.05	0.09															
2. Knowledge of illness	4.5	4.6	0.30	4.3	4.3	0.35	0.53	4.5	4.6	0.08	4.5	4.3	0.02	0.03															
3. Knowledge of nutrition	4.2	4.2	0.89	3.9	3.9	0.92	0.87	4.1	4.2	0.07	4.0	3.9	0.16	0.12															
4. Knowledge of disease prevention	4.4	4.3	0.83	4.0	4.0	0.60	0.86	4.2	4.3	0.33	4.1	4.0	0.29	0.27															
5. Knowledge related to long-term care	3.6	3.7	0.69	3.4	3.5	0.85	0.90	3.6	3.8	0.08	3.4	3.5	0.69	0.32															
6. Knowledge related to medical expenses	4.0	4.1	0.98	3.7	3.8	0.77	0.85	3.7	4.0	0.01	3.8	3.8	0.58	0.10															
7. Knowledge related to air and water pollution	3.8	3.7	0.38	3.3	3.3	0.55	0.83	3.4	3.6	0.09	3.3	3.3	0.80	0.37															
8. Knowledge related to lifestyle and health	4.3	4.1	0.15	3.9	3.9	0.55	0.38	3.8	4.0	0.10	3.8	3.7	0.66	0.19															
9. Knowledge related to human behavior and psychology	3.8	3.9	0.96	3.6	3.7	0.98	0.96	3.6	3.8	0.04	3.5	3.4	0.45	0.11															
10. Knowledge related to health and medicine in education	4.4	4.3	0.36	3.9	4.0	0.96	0.62	4.1	4.1	0.78	4.1	4.0	0.12	0.49															

DID: Difference-in-differences analysis.

a) Wilcoxon signed-rank test.

b) p-value of DID adjusted for sex, school grade, medical worker in family, conversation with pharmacist, original manga, interest in a career as a pharmacist.

c) p-value of DID adjusted for sex, age, medical qualification, medical worker in family, conversation with pharmacist, original manga.

Table 5

Comparison of the perception of aptitudes of pharmacists between the exposed and non-exposed groups.

Item of aptitude	High school students (n = 232)							Guardians (n = 275)						
	Exposed (n = 92)			Unexposed (n = 140)			DID p ^{b)}	Exposed (n = 105)			Unexposed (n = 170)			DID p ^{c)}
	Pre	Post	p ^{a)}	Pre	Post	p ^{a)}		Pre	Post	p ^{a)}	Pre	Post	p ^{a)}	
1. Precision (Liking work that requires accuracy)	4.4	4.4	0.48	4.3	4.1	0.06	0.17	4.5	4.8	0.003	4.5	4.4	0.18	0.01
2. Cooperativeness with others (Listening to people's opinions)	4.2	4.3	0.51	4.0	3.8	0.06	0.16	4.1	4.4	0.004	4.1	4.0	0.23	0.01
3. Diplomatic/Sociable (Enjoy speaking with people)	4.2	4.2	0.57	3.9	3.9	0.98	0.77	3.9	4.2	0.005	3.7	3.8	0.81	0.18
4. Logical thinking	4.1	4.0	0.34	3.9	3.9	1.00	0.88	4.1	4.1	0.43	3.9	3.9	0.77	0.97
5. Humility (Modest, unassertive person)	3.9	4.0	0.25	3.6	3.6	0.82	0.44	4.0	4.0	0.79	3.6	3.6	0.56	0.90
6. Leadership (Bringing ideas together)	4.1	4.1	0.81	3.8	3.7	0.91	0.84	3.9	4.0	0.45	3.7	3.6	0.44	0.39
7. Skill-oriented (valuing the rewards of achieving difficult goals)	4.2	4.2	0.82	3.9	3.9	0.52	0.65	4.0	4.1	0.17	3.9	3.8	0.38	0.25
8. Decisiveness (assess the situation correctly and promptly)	4.3	4.2	0.43	4.0	4.0	0.75	0.52	4.0	4.3	0.01	3.9	3.8	0.37	0.03
9. Consideration/careful attention	4.3	4.2	0.37	4.1	4.0	0.44	0.99	4.2	4.4	0.02	4.0	4.0	0.76	0.14
10. Work-oriented (Good skill in working with hands)	4.2	4.2	0.96	4.0	3.9	0.23	0.75	4.1	4.2	0.23	4.0	4.0	0.94	0.57

DID: Difference-in-differences analysis.

a) Wilcoxon signed-rank test.

b) p-value of DID adjusted for sex, school grade, medical worker in family, conversation with pharmacist, original manga, interest in a career as a pharmacist.

c) p-value of DID adjusted for sex, age, medical qualification, medical worker in family, conversation with pharmacist, original manga.

decreased for one item in the unexposed group. As a result, the only item that showed a significant difference by DID was “knowledge of illness”.

3.4. Aptitudes of a pharmacist (see Table 5)

Among high school students, no significant differences were found in the before/after viewing comparisons of either group or in the analysis by DID. In contrast, the exposed group for the guardians showed an increase in mean scores for five items in the before/after comparison, while no significant differences were found in the unexposed group. DID analysis revealed significant differences in “precision,” “cooperativeness with others,” and “decisiveness.”

3.5. Communication required for pharmacists (see Table 6)

For the exposed high school students, there were no significant differences between pre- and post-viewing, and only the unexposed group had significant decreases in the scores for two items. For guardians, there were no significant differences pre- and post-viewing in either group. DID analysis showed no significant differences for either high school students or guardians.

Table 6

Changes in perception of necessity of good communication skills for pharmacists: comparison between the exposed and non-exposed groups.

Communication partner	High school students (n = 232)							Guardians (n = 275)						
	Exposed (n = 92)			Unexposed (n = 140)			DID p ^{b)}	Exposed (n = 105)			Unexposed (n = 170)			DID p ^{c)}
	Pre	Post	p ^{a)}	Pre	Post	p ^{a)}		Pre	Post	p ^{a)}	Pre	Post	p ^{a)}	
1. Inpatients or Outpatients in hospital pharmacy	7.9	7.9	0.69	7.7	7.0	0.003	0.17	8.5	8.4	0.96	7.8	7.7	0.89	0.96
2. Families of patients	7.7	7.6	0.90	7.2	6.8	0.14	0.49	7.8	7.9	0.23	7.4	7.4	0.80	0.77
3. Doctors	8.0	7.7	0.20	7.6	7.0	0.01	0.61	8.4	8.3	0.91	7.9	7.8	0.71	0.95
4. Nurses	7.7	7.5	0.25	7.2	6.8	0.06	0.68	8.3	8.1	0.85	7.7	7.7	0.96	0.68
5. Pharmacists	7.9	7.7	0.33	7.4	7.0	0.07	0.56	8.3	8.2	0.88	7.8	7.7	0.90	0.97
6. People living near hospitals	6.9	7.0	0.56	5.7	5.8	0.54	0.90	6.1	6.0	0.76	5.5	5.6	0.61	0.90
7. Long-term care workers at nursing homes	7.5	7.2	0.19	6.6	6.6	0.96	0.42	7.5	7.2	0.59	6.8	6.8	0.90	0.52
8. Medical clerks in hospitals	7.5	7.4	0.58	6.9	6.6	0.09	0.70	7.7	7.4	0.17	7.3	7.0	0.20	0.95
9. Registered dietitians in hospitals	7.7	7.2	0.09	6.8	6.6	0.37	0.59	7.6	7.4	0.83	7.0	7.0	0.98	0.79
10. Physical therapists in hospitals	7.4	7.2	0.22	6.8	6.7	0.54	0.84	7.5	7.3	0.35	7.1	7.0	0.75	0.78

DID: Difference-in-differences analysis.

a) Wilcoxon signed-rank test.

b) p-value of DID adjusted for sex, school grade, medical worker in family, conversation with pharmacist, original manga, interest in a career as a pharmacist.

c) p-value of DID adjusted for sex, age, medical qualification, medical worker in family, conversation with pharmacist, original manga.

awareness of “Collaboration with health care professionals” and “Information sharing about medication therapy,” as well as recognition of the importance of “precision,” “cooperativeness with others,” and “decisiveness” as aptitudes of pharmacists. These findings could be linked to the themes of the storyline in the drama, such as team medical care. A previous study²⁰ reported that non-healthcare students who watched medical TV shows with scenes of surgical procedures were more knowledgeable of surgical operations than those who did not, and the increased awareness of the work of hospital pharmacists among high school students and guardians in this study seem to be consistent with this.

The main character in the drama, a hospital pharmacist, communicated with pharmacist colleagues, physicians, community pharmacists, and patients and their families, and the drama also included scenes of home visits for cancer patients in terminal care. The drama was medically supervised and portrayed the pharmacists engaged in interpersonal work as a whole. Nevertheless, based on the DID analysis, there were no significant differences noted in the survey responses of the respondents regarding the importance of effective communication for pharmacists. Most items in both groups of high school students and guardians had the same or lower mean scores in the post-survey compared to the pre-survey, suggesting that the respondents recognized and rated a certain level of necessity in communication skills at baseline or that the 11-point scale may have been difficult to assess. In addition, it was inferred that the participants understood that the portrayal of the pharmacists was a fictional rather than reality. Two possible explanations were brought forward. First, if the respondents mostly knew pharmacists in the real world with ineffective communication skills, they might have felt that the portrayal of pharmacists with good communication skills was out of the ordinary and thus it was fictional drama that was different from reality. Tominaga et al. reported that pharmacists felt that the pharmacist role was understood as just dispensing medicine that was prescribed to patients, and there was a need for them to further improve their communication skills.²¹ Norose et al. suggested from their study that patients expected pharmacists to have better interpersonal and communication skills.²² These indicate that a proportion of pharmacists in practice may be communicating ineffectively. The respondents might have felt that the portrayal of pharmacists with good communication skills was done solely for the drama and was not realistic. Second, the respondents might perceive it as just a fictional drama because it features popular actors. Lee et al.²³ reported that when the motive for viewing medical dramas was for life-related information or entertainment, viewers paid more attention to the story, resulting in reduced use of information from the medical drama. Following the questions regarding their perceptions of pharmacists, respondents who viewed the drama were directly asked if their impression of pharmacists changed after seeing the drama. Over 90% of high school students and over 60% of guardians responded that their impression of pharmacists had changed, suggesting that the drama provided an opportunity to learn more about pharmacists. If questions about the role of pharmacist in the post-survey had been asked directly in relation to the drama, the difference in responses before and after the airing might have been more apparent. The impact of the drama could be assessed neutrally through this drama-unguided survey method. However, it is unclear whether these changes will persist, and long-term studies to evaluate the sustainability of perceptions influenced by media portrayals of pharmacists are needed.

In previous studies regarding health professionals, most students, such as medical and nursing students, believed that the ideals of professionalism of doctors and nurses were depicted positively in the medical drama.²⁴ In contrast, Glerean et al.¹² reported that media, such as hospital drama, had presented a negative image of nurses to young people. However, to the best of our knowledge, no studies have been conducted on how high school students perceive the portrayal of pharmacists depicted in the medical drama.

In Japan, under the Revision of the Pharmaceutical and Medical Device Act in 2019,^{25,26} pharmacists should monitor patients who need to be checked regarding medication use, occurrence of drug side effects, etc. after providing medication and consultation at the pharmacy

(e.g., “telephone follow-up”). Furthermore, providing and sharing patient information for appropriate medication therapy with medical professionals such as physicians in other institutes was strongly recommended (this is known as a “tracing report”). It is important for hospital pharmacists to share patient information with community pharmacists to ensure that patients receive seamless and appropriate medication treatment. The usefulness of “tracing reports” and “telephone follow-up” have been widely reported.^{27,28}

For patient-centered medication treatment, trusting relationships with patients and their families and collaboration with other health professionals are becoming increasingly important, requiring pharmacists to have good communication skills.

In the baseline results of this survey,¹⁹ both high school students and guardians had low perceptions about the interpersonal conduct required effective communication skills of hospital pharmacist and community pharmacists. In particular, the perception of pharmacists by the guardians was more likely to be that their work was non-personal, suggesting that they may have responded with an old-fashioned image of pharmacists whose primary role was dispensing medicines.

If high school students and their parents sufficiently understand the current role of pharmacists properly before making career choices, it may help them fill in the gaps in their stereotypical perceptions. To raise awareness of the roles of pharmacists among high school students and their parents, “School Pharmacists,” who are assigned to each school (except universities) and are mainly responsible for school environment health,²⁹ could be utilized. Health counseling and guidance services have been added to their work, and they are often in charge of drug abuse prevention and/or education on proper medication use at junior high schools and high schools.³⁰ Because school pharmacists work as community or hospital pharmacists in many cases, they are expected to actively tell students about the roles of pharmacists, including family pharmacists, in classes.³¹ To increase public awareness of the work of pharmacists, it is vitally important for pharmacists to improve their own communication skills and actively engage with patients, their families, and local residents. It is desired that high school students would aspire to become pharmacists after fully recognizing the role of pharmacists.

4.1. Strengths and limitations

The main strength of this study was that it was conducted prior to the airing of the first drama series featuring a hospital pharmacist in Japan. Additionally, the data from the pre-and post-survey was categorized into two groups of exposed and unexposed respondents, and the quasi-experimental design was successfully used.

This study has several limitations. First, because respondents were divided into two groups according to their viewing behavior, their attitudes and interests toward pharmacists may differ. Therefore, we adjusted for those variables in the DID analysis. Furthermore, the DID method is not suitable if there are shocks other than the drama in the exposure group; however, in the year 2020, there were many behavioral restrictions due to COVID-19, and shocks only to the exposure group are unlikely. Second, it was unclear which episodes the participants in the exposure group viewed because the drama consisted of 11 episodes. Thus, there is a possibility that the perception of the work of the pharmacist was affected by the different scenes in the episodes that they viewed. If by chance a scene not seen is in the pharmacist work item to respond, the effect of the drama may be estimated to be smaller than it is. The exclusion of the group that viewed the drama only once from the analysis and asking enough number of items about the pharmacist work could have reduced the margin of error. Third, as the same questions were asked in both surveys before and after the airing of the drama, there is a possibility of bias due to survey participants remembering the content. However, it was unlikely that the results were affected by the bias because the same questions were asked in both the exposed and unexposed groups, and DID analysis was conducted. Fourth, the high school students and the guardians were not paired; thus, the child-parent relationship was not analyzed. Finally, the respondents

were registered members of the Internet survey company and participated in the survey two times voluntarily; therefore, it is important to bear in mind the possibility of bias in these responses. However, since a company with a large number of registered members living across Japan was used and this is the first study to evaluate the impact of a drama on the perception of pharmacists in Japan, the results can be utilized as valuable findings.

5. Conclusion

The medical drama had some impact on high school students' and guardians' perceptions of pharmacists and could be useful as an opportunity to learn more about pharmacists. However, the importance of communication skills for pharmacists may not have been adequately conveyed. It is suggested that it is important for pharmacists to actively engage and communicate with patients, their families, and community residents and make them understand their work in the real world.

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CRediT authorship contribution statement

Natsuyo Yanagi: Conceptualization, Methodology, Formal analysis, Writing – original draft, Project administration. **Hiroki Satoh:** Conceptualization, Methodology, Writing – review & editing, Project administration, Supervision. **Yasufumi Sawada:** Conceptualization, Methodology, Writing – review & editing, Supervision.

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