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Research paper

Factors associated with influenza vaccination in Japanese elderly outpatients

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KEYWORDS
Influenza;
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Abstract *Background:* Elderly patients benefit from influenza vaccination, but the number of Japanese elderly patients who are vaccinated is insufficient. Several factors are associated with influenza vaccination acceptance, but little is known about Japanese elderly outpatients. The purpose of this study was to examine factors associated with influenza vaccination in elderly outpatients in Japan.
Methods: During the 2017–2018 influenza season, outpatients from one hospital and one clinic in Kitaibaraki City, Ibaraki, Japan, participated in this study. Patients answered a self-report questionnaire exploring factors such as their vaccination status during the 2017–2018 season, past influenza vaccination, perceived susceptibility to influenza and adverse events of the vaccine, perceived vaccine efficacy, physician recommendations. Multivariable logistic regression analyses were conducted to identify factors associated with vaccination.
Results: Of 377 patients, 316 (83.8%) responded, and the vaccination rate was 57%. Eighty-three patients (27.0%) reported that their physician recommended the influenza vaccine. In multivariate analysis, influenza vaccination was associated with higher age (odds ratio (OR) 1.09, 95% confidence interval (CI) 1.03–1.14), physician recommendations (OR 2.49, 95% CI 1.18–5.25), low perceived susceptibility to vaccine-related adverse events (OR 0.33, 95% CI 0.15–0.74), and belief in vaccine efficacy (OR 4.73, 95% CI 2.08–10.8).
Conclusions: Influenza vaccination was associated with belief in vaccine efficacy, perceived

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susceptibility to vaccine-related adverse events, physician recommendations, and older age. Increasing the frequency of physician recommendations may lead to increased vaccination coverage.

Highlights

- Influenza vaccination coverage in Japanese elderly has remained at around 50%.
- Belief in the efficacy and safety of the influenza vaccine was important factors.
- Increasing the frequency of physician recommendation may lead to increased coverage.

Introduction

The elderly are especially vulnerable to influenza [1]; it is estimated that individuals over the age of 65 comprised 60% of influenza-associated hospital admissions during the 2017—2018 season in Japan [2]. Influenza prevention is important in the elderly, and the influenza vaccine effectively prevents influenza illness [3].

However, the influenza vaccination coverage of targeted populations in Japan has remained at around 50% since 2004 [4,5]. This rate is not high compared to other countries [6]. In 2002, the Preventive Vaccination Law in Japan stipulated that vaccinations should be administered to all individuals over the age of 65 and to those over the age of 60 with high-risk medical conditions such as chronic heart disease. To prevent influenza, it is necessary to increase vaccination coverage in individuals aged 65 years and older, and this will require determining why people do or do not receive influenza vaccination.

Previous studies in elderly subjects identified factors associated with influenza vaccination, including perceived susceptibility to and severity of influenza, belief in the efficacy of the influenza vaccine, perceived risk of adverse reactions, and recommendations of others [7,8]. Factors such as race, ethnicity, and geographic and cultural characteristics are also associated with influenza vaccination [9]. The recommendation of physicians is an especially important factor [10], probably because patients who trust their physicians are more likely to engage in preventive behavior [11].

Influenza vaccination policy has a unique history in Japan. In 1976, the Preventive Vaccination Law mandated influenza vaccination for school-age children. The law was relaxed in 1987, and excluded the influenza vaccine in 1997 due to public concern [12]. The law now stipulates that the purpose of influenza vaccination is individual prevention. This is distinguished from children's vaccines, which are mandatory in order to achieve herd immunity. As a result of this unique background, elderly Japanese may have a different view of the influenza vaccine than the elderly in other countries.

Few studies have investigated why Japanese elderly people do or do not receive the influenza vaccine. Previous research in Japan includes one study that targeted outpatients over 18 years of age [13], and another that targeted working individuals up to 69 years of age [14,15]. These reports targeted a limited number of people aged 65 years and older. Matsui et al. investigated individuals in a healthy rural community, and separately analyzed those aged 18—64 years and those aged 65 years and older [16]. Their study reported similar results to previous studies in other countries, but did not investigate physicians' recommendation, and performed only univariate analysis.

In this study, we targeted elderly outpatients following reasons; First, elderly outpatients may be more vulnerable to influenza because of comorbidities than healthy individuals. Second, elderly outpatients may also accept the recommendation of a primary care physician to receive vaccine. Since elderly outpatients are seen by their primary care physicians during consultations, access to them may be greater than to healthy individuals, which can lead to increased influenza vaccination coverage.

This study sought to understand the decisions of Japanese elderly outpatients regarding influenza vaccination by analyzing factors associated with the vaccination and the reasons why individuals choose not to receive it.

Methods

Study design and settings

We conducted a cross-sectional study for 2 weeks between January and February in 2018. In Japan, almost all influenza vaccinations for the 2017—2018 season were administered by December. Data were collected through a self-administered questionnaire. Study participation was solicited from outpatients visiting the Department of Internal Medicine at Kitaibaraki City Hospital (183 beds) or the Kitaibaraki Center for Family Medicine (clinic) in Kitaibaraki City, Ibaraki, Japan. These facilities provide primary care. Kitaibaraki City is a rural city located 200 km from Tokyo, with a population of about 43,000 people. The city's aging rate is 32.2%, which is higher than Japanese average of 27.7%. All Japanese citizens have health insurance, but insurance does not cover vaccine costs. The influenza vaccination costs about 4000 yen (37.1 USD) in Japan, and this cost is usually halved for people aged 65 years and older.

Participants

We approached all patients aged 65 years and older who attended the hospital or clinic for the first time during the study period. We did not distinguish between patients with and without an appointment.

All patients aged 65 years and older who met the following two criteria were included in this study: first, the ability to understand the purpose of the study and complete the questionnaire, and second, the lack of a prior history of anaphylaxis due to influenza vaccination (self-reported).

The purpose of the study was explained to participants, and they were given a questionnaire by clinic or hospital staff members or by a research staff member at the reception desk. Patients were excluded if they stated that they lacked the ability to answer the questionnaire because of their general health condition, or if they, their family, or their caregiver considered them unable to answer the questionnaire because of a decline of cognitive status.

Participants completed the questionnaire before their physician consultation and returned the form to a staff member or placed it in a box near the consultation room.

Questionnaire

The questionnaire was anonymous and self-administered to ensure that participants would not feel pressured to provide a socially desirable answers due to concern that their opinions would be revealed to their doctors.

In creating the questionnaire, our research team referred to a previous study from Japan that was based on Health Belief Model components [16]. We tried to use the same Japanese expressions whenever possible, but did revise a few expressions to increase clarity for participants. To determine whether enough components were included, we also referred to a previous review [7] that listed several items that should be addressed in future research. Some components, such as past experience and perceived severity toward vaccine adverse events, were added.

We asked about basic characteristics such as age, sex, household size, comorbidities, regular visits, and whether the patient had a family physician. Self-rated health was assessed using a 5-point Likert scale: "very good," "good," "so-so," "bad," and "very bad" [17].

To determine whether a patient's trust in their physician affected whether or not they were vaccinated, we used the Trust in Physician scale (TiPs), which has been widely used to measure patients' trust in their physicians [11]. The Japanese version of TiPs consists of nine items [18]. Total scores range from 9 to 45, with higher scores indicating higher trust. It has been suggested that the Japanese version of TiPs can be used to measure trust in recently seen physicians as well as in the family physician [18].

Each participant reported whether or not they received the influenza vaccine during the 2017—2018 season (yes, no). The other constructs of the questionnaire are shown in Table 1, as follows: "Recommendation from physicians," "Past infection with influenza," "Vaccinated at some point in the past," "Experienced any vaccine adverse events," and "Familiar with the recommendation concerning influenza vaccination." Possible answers were "yes" and "no" for "Familiar with the recommendation

Table 1 Questionnaire constructs.

Constructs	Questions	Possible answers
Influenza vaccination in 2017—2018 season	Did you get influenza vaccine in 2017—2018 season?	Yes, No
Recommendation from physicians	Were you recommended to get vaccine from physicians?	Yes,
Past infection with influenza	Have you ever infected influenza in the past?	No,
Vaccinated at some point in the past	Have you ever got influenza vaccine in the past?	Don't know
Experienced any vaccine adverse events	Have you ever experienced vaccine adverse events?	
Familiar with the recommendation	Do you know who are recommended to get vaccine?	Yes, No
High perceived susceptibility to influenza	I believe I'm susceptible to influenza	Strongly agree,
High perceived severity to influenza	I believe influenza is a serious disease	Agree,
Belief in the efficacy of the vaccine	The vaccine is effective	Disagree,
High perceived susceptibility to adverse events	I believe I'm susceptible to vaccine adverse events	Totally disagree
High perceived severity to adverse events	I believe vaccine adverse events are serious	
Belief that annual vaccination is needed	I believe that an annual vaccine is needed	
Intend to receive the vaccine the following year	I intend to receive the influenza vaccine next year	
Desire to recommend the vaccine to others	I plan to recommend the vaccine to others	
Reasons for not receiving the influenza vaccine	I don't feel susceptible to influenza	Strongly agree,
	Influenza is not a serious disease	Agree,
	I don't trust the efficacy of the vaccine	Disagree,
	Fear of adverse events	Totally disagree
	I didn't have time	
	Influenza vaccine causes influenza	
	I dislike needles	
	I couldn't afford it	
	I didn't know where to get the vaccine	

concerning influenza vaccination," and "yes," "no," and "don't know" for the other constructs. We defined adverse events as swelling at the injection site or systemic symptoms.

Constructs about perceptions and beliefs regarding influenza and the influenza vaccine were as follows: "High perceived susceptibility to influenza," "High perceived severity of influenza," "Belief in the efficacy of the vaccine," "High perceived susceptibility to adverse events," "High perceived severity of adverse events," "Belief that annual vaccination is needed," "Intend to receive the vaccine the following year," and "Desire to recommend the vaccine to others." Possible answers were "strongly agree," "agree," "disagree," and "totally disagree," because it was thought that simple agree/disagree responses would not accurately elicit patients' opinions.

Patients who did not receive the influenza vaccine during the 2017—2018 season were asked why this was the case, using nine items based on a previous study from Japan [14], for example, "I don't feel susceptible to influenza," and "influenza is not a serious disease." Possible answers were "strongly agree," "agree," "disagree," and "totally disagree."

Statistical methods

We examined the factors associated with receiving the influenza vaccine during the 2017—2018 season. The influenza vaccination status that season was considered to be the dependent variable, and all other variables were independent variables. In the statistical analysis, categorical variables were divided into two categories: "yes" and "no," or "agree" and "disagree." The answer "don't know" was combined with "no." Self-rated health was divided into "good" and "bad," and "so-so" was combined with "bad," because we wanted to clearly focus on good subjective health. Other variables were divided into "agree" and "disagree." Differences in means were compared using the t-test or the Mann—Whitney U test. Differences in proportions were compared using the Chi-square test.

Independent variables associated with influenza vaccination during the 2017—2018 season were analyzed using a logistic regression model. We assessed multicollinearity based on Spearman's correlation coefficient. When the coefficient was more than 0.5, the variable with a higher p-value in the univariate analysis was excluded from the multivariate analysis. All variables were entered into the model simultaneously, and we assessed the model with the Hosmer—Lemeshow test. Finally, we adopted the model with the highest fitness. To examine whether the facility visited by patients influenced the results, we added a facility factor to the logistic regression model and ensured that the results did not change.

To determine the reason for lack of vaccination, we also analyzed the association between the reason why these patients had not received the influenza vaccine during the 2017—2018 season and their willingness to receive the vaccine the following year.

Statistical significance was defined as $p < 0.05$. Data were analyzed using IBM SPSS Statistics version 24.

Results

Basic characteristics

In total, 983 patients visited the hospital or clinic during the study period, but most patients stated that they could not answer the questionnaire because of their health status, including decline of vision or cognitive status. No patients reported a history of anaphylaxis. Questionnaires were distributed to 377 patients; of these, 30 declined to participate, and 31 were excluded due to missing data on sex, age, or vaccination status during the 2017—2018 season (Fig. 1). We finally analyzed 316 responses from participants (response rate 83.8%). They consisted of 270 participants (85.4%) from Kitaibaraki City Hospital and 46 participants (15.6%) from the Kitaibaraki Center for Family Medicine. The median age was 65 (interquartile range 69—81) years. One hundred sixty-three (53.6%) patients were men, and other basic characteristics are shown in Table 2. The median TiPs was 36 (interquartile range 32—39). Age and TiPs were not normally distributed.

Patients from the Kitaibaraki Center for Family Medicine were younger than those from Kitaibaraki City Hospital (71 (68—75) vs. 76 (69—82) years, respectively, $p < 0.01$) and included a lower percentage of women (15 (43.6%) vs. 139 (50.9%), $p = 0.022$). We analyzed the data from the two institutions together because they did not differ in the rate of influenza vaccine administration during the 2017—2018 season.

Experiences with and perceptions and beliefs about vaccination

Overall, 180 (57.0%) patients received the influenza vaccine during the 2017—2018 season. Eighty-three patients (27.0%) did so due to the recommendations of a physician. Fifty-six patients (17.8%) previously experienced influenza. Two hundred thirty-three patients (73.4%) were vaccinated at some point in the past, and of these, 19 (7.8%) experienced one or more adverse events. One hundred eighty-one patients (57.8%) stated that they knew the recommendations for receiving the influenza vaccine.

The perceptions and beliefs about influenza and influenza vaccination are shown in Fig. 2. Over 70% of patients stated that they believed the vaccine was effective, that annual vaccination is needed, and that they wanted to receive the vaccine the following year. One hundred eight patients (35.0%) considered themselves highly susceptible to influenza, while 54 (17.8%) considered themselves highly

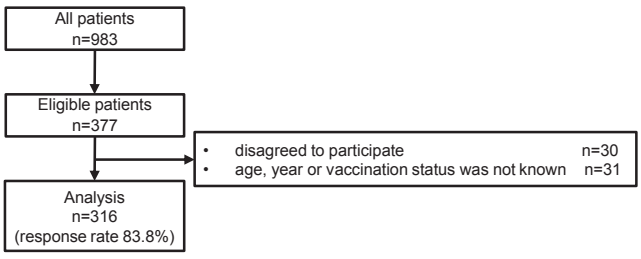

Figure 1 Study flow.

Table 2 Basic characteristics.

		n = 316
Age (median, IQR)		75 (69–81)
Sex (n, %)	Male	163 (52)
	Female	153 (48)
Study setting	Hospital	270 (85)
	Clinic	46 (15)
Household size (n, %)	One	40 (13)
	Two	150 (49)
	More than three	117 (39)
Regular visits (n, %)	Yes	297 (94)
Having family physician (n, %)	Yes	280 (89)
Comorbidity (n, %)	Cardiovascular	80 (27)
	Respiratory	22 (7.3)
	Renal	21 (7.0)
	Malignancy	16 (5.3)
	Diabetes	79 (26)
Trust in Physician Scale (median,IQR)		36 (32–39)
Self-rated health (n, %)	Very good	46 (15)
	Good	75 (24)
	So-so	127 (41)
	Bad	53 (17)
	Very bad	11 (3.5)

IQR; interquartile range.

susceptible to adverse events caused by the influenza vaccine.

Factors associated with vaccination

In bivariate analysis, several factors were associated with influenza vaccination (Table 3), including older age, female gender, past infection with influenza, past influenza vaccination, higher TiPs, perceived susceptibility to influenza and vaccine adverse events, and belief in the efficacy of the vaccine.

Before the multivariate analysis, we considered multicollinearity among the variables. More than 95% of vaccinated patients agreed with the statements, "Vaccinated at some point in the past," "Belief that annual vaccination is needed," and "Intend to receive the vaccine the following year." We excluded all of these factors because the coefficients between them were over 0.5. The coefficient between "Regular visits" and "Have a family physician was 0.64, so we chose "Regular visits" for univariate analysis because its p-value was smaller than that of "Have a family physician."

The excluded variables "Belief that annual vaccination is needed" and "Intend to receive the vaccine the following year" were correlated with "Desire to recommend the vaccine to others." Their correlation coefficients were over 0.5. The Hosmer–Lemeshow test showed better fitness when "Desire to recommend the vaccine to others" was not included in the model. We eventually included 11 variables simultaneously in the logistic regression model (Table 4).

In multivariate analysis, influenza vaccination during the 2017–2018 season was associated with older age (odds ratio (OR) 1.09, 95% confidence interval (CI) 1.03–1.14), recommendations by a physician (OR 2.49, 95% CI 1.18–5.25), belief in vaccine efficacy (OR 4.73, 95% CI 2.08–10.8), and low perceived susceptibility to adverse events (OR 0.33, 95% CI 0.15–0.74). The result of the Hosmer–Lemeshow test was p = 0.95. After controlling for the two facilities, these factors were still significant.

Reasons for not receiving the influenza vaccine

Patients who did not receive the influenza vaccine during the 2017–2018 season gave the following reasons: "I don't

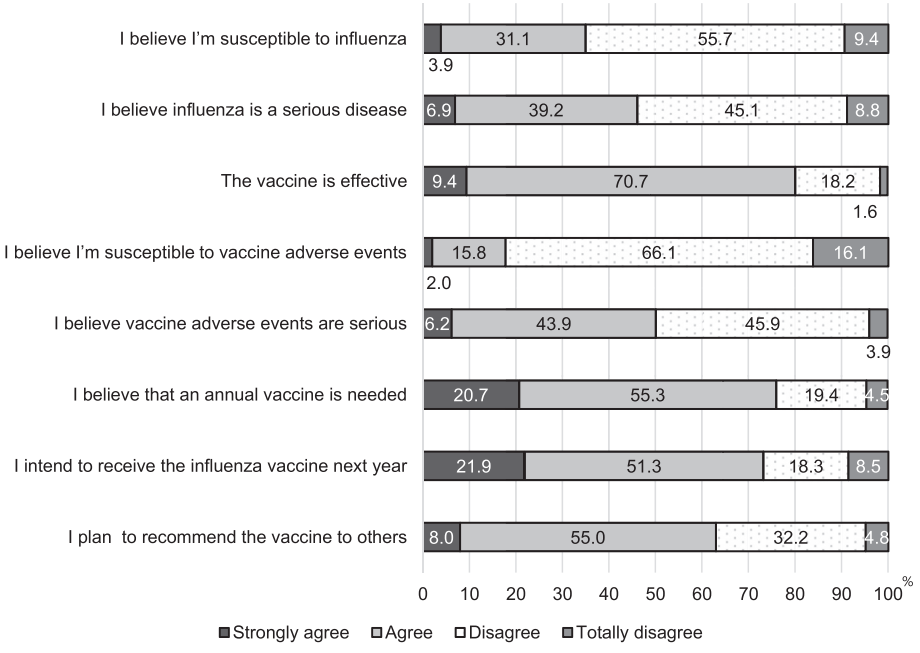

Figure 2 Perception and beliefs regarding influenza and the influenza vaccine.

Table 3 Factors associated with influenza vaccination (bivariate analysis).

	Vaccination in 2017–2018 season		
	no (n = 136)	yes (n = 180)	p
Age (median, IQR)	72 (68–78)	77 (70–82)	<0.01
Sex (n, %)			
Male	83 (61.0)	80 (44.4)	<0.01
Female	53 (39.0)	100 (55.6)	
Household size (n, %)			
One	17 (12.8)	23 (13.4)	0.41
Two	71 (53.4)	79 (45.9)	
More than three	45 (33.8)	70 (40.7)	
Regular visits (n, %)			
Yes	123 (90.4)	174 (96.7)	0.021
Having family physician (n, %)			
Yes	116 (85.3)	164 (92.1)	0.053
Comorbidity (n, %)			
Cardiovascular	33 (25.2)	47 (27.6)	0.63
Respiratory	8 (6.1)	14 (8.2)	0.48
Renal	6 (4.6)	15 (8.8)	0.15
Malignancy	9 (6.9)	7 (4.1)	0.29
Diabetes	38 (29.0)	41 (24.1)	0.34
Trust in Physician Scale (median, IQR)	35 (32–38)	36 (33–40)	0.045
Self-rated health (n, %)			
Good	54 (40.3)	67 (37.6)	0.63
So-so, Bad	80 (59.7)	111 (62.4)	
Recommendation from physicians	19 (14.1)	64 (37.2)	<0.01
Past infection with influenza	15 (11.1)	41 (22.8)	<0.01
Vaccinated at some point in the past	54 (39.7)	178 (98.9)	<0.01
Experienced any vaccine adverse events	5 (9.6)	14 (7.9)	0.69
Familiar with the recommendation	64 (47.8)	115 (65.3)	0.020
High perceived susceptibility to influenza	38 (28.1)	70 (40.2)	0.027
High perceived severity to influenza	52 (39.4)	89 (51.1)	0.041
Belief in the efficacy of the vaccine	85 (63.9)	161 (92.5)	<0.01
High perceived susceptibility to adverse events	35 (26.9)	19 (10.9)	<0.01
High perceived severity to adverse events	66 (51.2)	87 (49.4)	0.77
Belief that annual vaccination is needed	64 (47.8)	171 (97.7)	<0.01
Intention to receive the vaccine the following year	55 (41.4)	169 (97.7)	<0.01
Desire to recommend the vaccine to others	53 (39.6)	143 (80.8)	<0.01

IQR; interquartile range. Difference in age and Trust in Physician Scale were analyzed with the Mann-Whitney U test. The other variables were analyzed with the Chi-square test.

feel susceptible to influenza" (44 patients (43.6%)) and "influenza is not a serious disease." 37 patients (36.7%). The other results are shown in Fig. 3.

Forty-one percent of patients who did not receive the influenza vaccine this season wanted to receive it next season. These patients were more likely to report that they were not vaccinated this season due to "no time" than patients who did not want to receive the vaccine next season (18 patients (43.9%) vs. 12 patients (20.7%), p = 0.013). The other answers did not differ regardless of past vaccination status or willingness to receive the vaccine next season.

Discussion

More than 95% of patients who received the influenza vaccine during the 2017–2018 season were vaccinated at some point in the past, recognized the necessity of annual vaccinations, and intended to receive the vaccine the following season. Our study indicated that influenza vaccination was associated with belief in the efficacy of the vaccine, perceived susceptibility to adverse events, vaccine recommendations by physicians, and older age.

Our study demonstrated that belief in the efficacy and safety of the vaccine was one of the most important reasons why Japanese outpatients received the influenza vaccine. Similar results were obtained in several previous studies [19], including one performed in a Japanese rural community [16]. Some Japanese studies pointed out that there is skepticism in Japan regarding vaccine efficacy [20]. An analysis of a massive web-based question dataset in Japan revealed that effectiveness and safety are major public concerns regarding influenza vaccination [21]. Further, Japanese primary care physicians stated that doubts about safety and efficacy were the primary barriers

Table 4 Factors associated with influenza vaccination (multivariate logistic regression analysis).

		Odds ratio	(n = 243)
			95% CI
Age		1.09	1.03–1.14
Sex	(female = 0)	0.65	0.34–1.24
Regular visits	(no = 0)	2.84	0.51–15.8
Trust in Physician Scale		1.01	0.95–1.07
Past infection with influenza	(no = 0)	2.25	0.99–5.10
Recommendation by a physician	(no = 0)	2.49	1.18–5.25
Familiar with the recommendation	(no = 0)	1.61	0.85–3.06
High perceived susceptibility to influenza	(no = 0)	1.93	0.92–4.04
High perceived severity to influenza	(no = 0)	1.54	0.78–3.06
Belief in the efficacy of the vaccine	(no = 0)	4.73	2.08–10.8
High perceived susceptibility to adverse events	(no = 0)	0.33	0.15–0.74

preventing patients from receiving the vaccine [22]. Medical professionals, as one of the most trusted resources regarding vaccination [23], need to provide information about efficacy and safety.

Only 27% of patients in this study reported that physicians had recommended that they receive the vaccine, although 61% of Japanese primary care physicians reported that they regularly recommended the influenza vaccine [22]. This rate is nearly consistent with the rate of 24% identified in an outpatient survey in Japan targeting individuals aged 18 years and older [13]. Considering that most patients in our study regularly visit physicians, this rate was relatively low compared with the percentage of 51% identified in an outpatient study in Hong Kong [24]. Whether or not physicians recommend the vaccine is influenced by their own vaccination status and beliefs about vaccine efficacy and cost effectiveness [25]. These factors may prevent some physicians from regularly recommending the influenza vaccine. Other possible reasons for this discrepancy are that physicians forget to recommend the vaccine and that patients forget that physicians had recommended it.

Consistent with previous studies [26,27], our results showed that a physician's recommendation was associated with influenza vaccination. One study revealed about half of unvaccinated patients reported that they would have

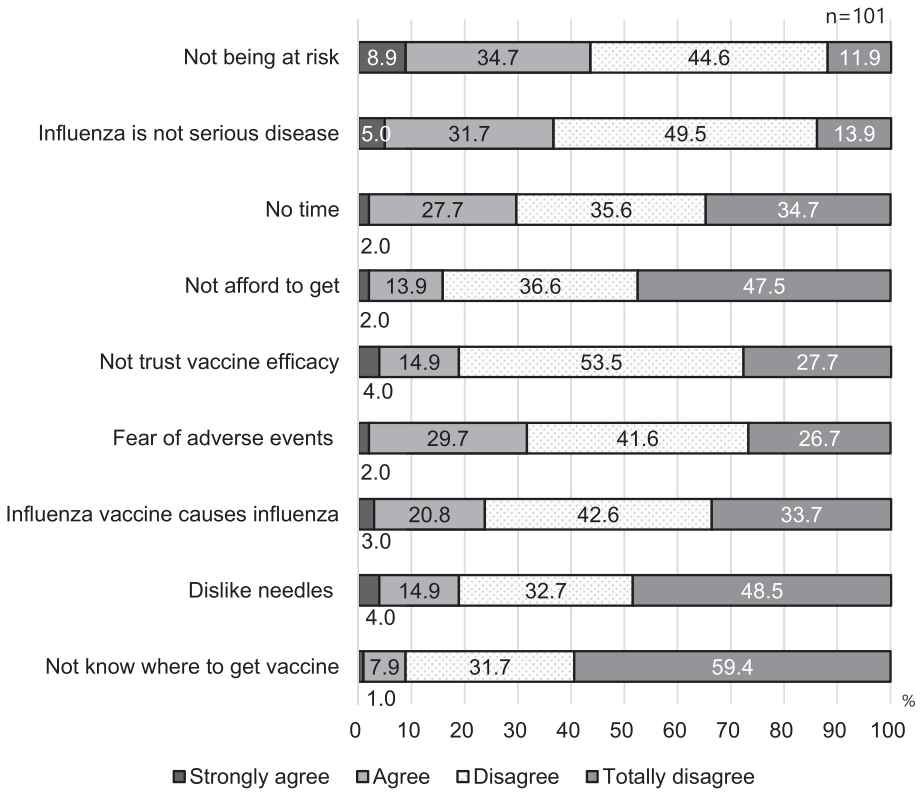

Figure 3 Reasons for not receiving the influenza vaccination.

received the influenza vaccine if a physician had recommended it to them [28]. A study in which physicians were reminded to do so increased the vaccination rate [29]. Increased recommendation of the vaccine and accurate provision of information by physicians may lead to increased vaccine uptake.

We investigated the association between trust in physicians and influenza vaccination. Trust in physicians was associated with vaccination in bivariate analysis, but not in multivariate analysis. No studies have used validated tools to assess trust in physicians. Qualitative studies showed that strong rapport and trust between patients and their primary care providers was associated with vaccination [30,31]. It is possible we were unable to precisely assess trust with TiPs, which was previously used in other contexts such as decision making regarding treatments [32].

In our study, older patients were more likely to receive the influenza vaccine. One study suggested that age had no effect after controlling for confounders [33]. However, most studies have found that older age increases the likelihood of receiving the influenza vaccine [27,34], and our study supported their conclusion.

Forty-one percent of unvaccinated patients wanted to receive the influenza vaccine the following season. This result was higher than in previous studies in high-risk older outpatients [35,36]. Patients who hoped to be vaccinated in the future were likely to state that they did not get vaccinated during the current season because of lack of time. We assume that issues regarding accessibility, for instance travel time and distance to hospitals, are important barriers to vaccination in these patients. Our study surveyed a limited number of reasons for lack of vaccination, so further studies are needed to investigate additional factors and formulate more specific approaches to unvaccinated patients.

In our study, 40% of unvaccinated patients were previously vaccinated. This rate is higher than those in other studies, which ranged from 25 to 30% [28,37]. In the 2017—2018 influenza season in Japan, the Ministry of Health, Labor and Welfare announced that due to a potentially insufficient supply of the influenza vaccine, "A single injection must be used in patients 13 years old and older unless the doctor specifically deems it necessary (the Japan Pediatric Society recommends two dose of vaccine for children under the age of 12 years). It is also mandatory that the vaccine be used more efficiently than last year so as not to waste it" [38]. Although the government eventually reported that the total supply in the 2017—2018 season exceeded the expected demand and was not decreased relative to the previous season [39], the original statement was widely reported, and our institutions had to stop influenza vaccinations for a few days because of the delayed supply. Although we could not assess the impact of this event on vaccination rates, it is assumed that some patients who wanted to receive the influenza vaccine were unable to do so.

Limitations

This study had several limitations. First, although the vaccination rate in our study was similar to those in other Japanese studies [4,5], our study was implemented in only two facilities and therefore selection bias may have been present. The study participants were younger than the overall patient populations at the two facilities from which they were recruited, and were also younger than general elderly outpatients in Japan as shown by a Japanese ministry survey of medical institutions [40]. Our study used a self-reported questionnaire, and this may have resulted in younger, healthier, and more independent study participants.

Second, our study was conducted during a 2-week period from January to February. This may have affected perceived susceptibility to and severity of influenza because the seasonal influenza epidemic occurred during the study period in Japan. Also, the self-reported influenza vaccination status may differ from the actual vaccination status based on medical records [41], so the vaccination coverage in our study may be different from the true vaccine coverage rate. However, we believe that the chosen study period was associated with a low risk of inaccurately self-reported vaccine coverage.

Third, the validity and reliability of the questionnaire used in this study was not confirmed. We did not investigate psychological factors like subjective norms and perceived behavioral control. We also did not investigate physical barriers such as multimorbidity [42], contextual barriers such as access to medical institutions, and sociodemographic barriers such as economic status. Furthermore, we focused only on patient factors, although factors related to medical professionals and facilities and the supply of vaccines may have influenced the vaccination coverage. Cultural characteristics such as collectivism in Japan [43] may also influence vaccine acceptance. There may be other factors associated with influenza vaccination in Japanese elderly outpatients, so future studies that utilize more detailed questionnaires are needed.

Fourth, our study used a small sample size, so some factors that were insignificant in multivariate regression analysis could ultimately be found to be significant in future studies with larger sample sizes.

Conclusion

Influenza vaccination was associated with belief in vaccine efficacy, perceived susceptibility to adverse events, physician recommendations, and older age. Increasing the frequency of physician recommendations may lead to increased vaccination coverage.

Ethics

The Kitaibaraki City Hospital medical ethics committee approved this study on December 26, 2017 (approval number 0004).

Authorship statement

NK and SU contributed to collecting and analyzing the data. NK, YK, RG, TM, YS, ST, and TM contributed to the designing the survey. NK, YK, RG, and TM interpreted the data. NK,

YK, TM drafted and edited the manuscript. All authors provided critically review and approved the final manuscripts.

Conflict of interest

The authors report no conflict of interest.

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Provenance and peer review

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