

Awareness, Knowledge, and Vaccine Acceptability of Herpes Zoster in Korea: A Multicenter Survey of 607 Patients

Nam Kyung Roh¹, Young Min Park², Hoon Kang³, Gwang Seong Choi⁴, Beom Joon Kim⁵, Yang Won Lee^{1,6}, Bark Lynn Lew⁷, Woo Young Sim⁷

¹Department of Dermatology, Konkuk University School of Medicine, ²Department of Dermatology, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, ³Department of Dermatology, St. Paul's Hospital, College of Medicine, The Catholic University of Korea, Seoul, ⁴Department of Dermatology, Inha University School of Medicine, Incheon, ⁵Department of Dermatology, Chung-Ang University College of Medicine, ⁶Research Institute of Medical Science, Konkuk University, ⁷Department of Dermatology, Kyung Hee University School of Medicine, Seoul, Korea

Background: Herpes zoster (HZ) infection can significantly impair the quality of life of the affected individuals, and its treatment imposes a considerable cost burden on the health-care system and on society at large. However, there is little information on the perception of this disease and the acceptability of vaccines in Korea. **Objective:** The aim of this study is to determine the awareness of HZ and its vaccine, and to identify factors associated with the acceptability of the HZ vaccine among outpatients of dermatology clinics. **Methods:** A questionnaire-based survey was conducted on 607 outpatients who visited the dermatologic clinics. **Results:** The responses of the patients revealed a high awareness of HZ (85.4%) but a relatively low knowledge about HZ and its vaccine (42.3%). The HZ vaccination rate among patients aged ≥ 50 years was 9%. A history of HZ infection, being older, and greater knowledge about HZ and its vaccine were associated with a higher HZ vaccine acceptability. Of those who had not been vaccinated, 58.3% were interested in receiving the vaccine. The most frequent reason for this interest was "severe sequelae," followed by "knowing someone who has HZ" and "recommendation from a doctor." High cost was the most common reason for unwillingness to receive

the vaccination. **Conclusion:** Despite a high awareness of HZ, vaccine acceptability was extremely low among this study cohort. Vaccination acceptability would be improved by encouraging doctors to educate elderly patients about the disease and the availability of vaccination, and by the provision of insurance coverage for HZ vaccination. (*Ann Dermatol* 27(5) 531~538, 2015)

-Keywords-

Awareness, Herpes zoster, Knowledge, Questionnaires, Vaccination

INTRODUCTION

Herpes zoster (HZ) infection (commonly known as shingles) occurs after reactivation of latent *Varicella zoster* virus infection, and manifests as groups of painful vesicular rashes. This disease frequently leads to prolonged pain and has a considerable impact on the quality of life, particularly in older patients¹. The incidence, severity, and complications of HZ increase with age, and $> 50\%$ of all patients in whom HZ develops are older than 60 years. Complications associated with HZ occur in almost half of all elderly patients². The most common of these complications is postherpetic neuralgia (PHN), which is defined as pain in HZ lesions that lasts longer than 3 months³. There is no universally accepted treatment for PHN, and the available treatments are accompanied by considerable adverse effects. Elderly patients with PHN often need to make multiple visits to medical offices for prescription analgesics in attempts to resolve the pain⁴. An effective vaccine against HZ has been developed and

Received September 30, 2014, Revised December 24, 2014, Accepted for publication February 16, 2015

Corresponding author: Yang Won Lee, Department of Dermatology, Konkuk University School of Medicine, 120 Neungdong-ro, Gwangjin-gu, Seoul 05029, Korea. Tel: 82-2-2030-5172, Fax: 82-2-2030-5179, E-mail: 20050078@kuh.ac.kr

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

can reduce the incidence and severity of both HZ and PHN by 51% and 67%, respectively. Furthermore, the vaccine reduces the burden of illness due to HZ by 61% (defined in a double-blind, placebo-controlled trial, the shingles prevention study, by using a composite measure of incidence, severity, and duration of pain)². In addition, vaccine protection may persist for at least 7~10 years, as observed in the long-term persistence substudy⁵. Finally, the US Food and Drug Administration approved HZ vaccination in 2011 for immunocompetent patients aged 50 years or older⁶. Despite the availability of a vaccine, HZ is still seen frequently in clinical practice.

The aim of this study was to determine the awareness of HZ and its vaccine, and to identify factors associated with the acceptability of the HZ vaccine among outpatients of dermatology clinics in Korea.

MATERIALS AND METHODS

Population

This was a multicenter study with participation by dermatology clinics from the following six university hospitals in South Korea: Konkuk University Hospital, Seoul; Seoul St. Mary's Hospital, Seoul; St. Paul's Hospital, Seoul; Inha University Hospital, Incheon; Chung-Ang University Hospital, Seoul; and Kyung Hee University Hospital at Gangdong. During the period from January to August 2014, the research team members collected data from eligible patients by using a questionnaire developed by the investigators. A total of 607 patients participated in this study. The patients were informed that the questionnaire was anonymous and confidential, and all who agreed to be involved provided verbal or written informed consent to participate. The protocol was approved by the institutional review board of each institution (IRB number of principal investigator's institution: KUH 1120045), in accordance with the principles of Good Clinical Practice and the Helsinki Guidelines.

Measures

The questionnaire (comprising 16 questions) was structured into the following four main parts: (i) sociodemographic characteristics of the participants (Q1~Q5, Q10), (ii) awareness of HZ (Q6~Q8), (iii) knowledge about HZ and its vaccination (Q9~Q12), and (iv) acceptability of HZ vaccination (Q13~Q16). The survey included questions concerning residence, age, sex, educational level, personal medical history (including cardiovascular diseases, diabetes mellitus, cancer, gastrointestinal diseases, and renal diseases), personal history of HZ, and a family history of HZ. The respondents were allowed to choose

multiple answers for the question about personal medical history. The respondents scored the severity of cancer, heart disease, hypertension, diabetes mellitus, cerebral diseases, HZ, and atopic dermatitis (range, 1~5). To assess the awareness of HZ, the participants were asked whether they had ever heard of the disease. Furthermore, knowledge about HZ and its vaccination was addressed by using 14 questions with answer choices of "yes," "no," and "do not know"; the questions were on the pathophysiology and epidemiology of HZ (Q1~Q4), symptomatology and sequelae of HZ (Q5~Q8), and HZ vaccines (Q9~Q14). Respondents with a history of HZ were asked to choose which of the following symptoms they found to be the most difficult to tolerate: acute pain and itching sensation, acute vesicles and rash, sensory disturbances, PHN, post-herpetic scar, and infections; the respondents were allowed to choose multiple answers. They were also asked to evaluate the degree of pain from HZ on a visual analogue scale (VAS) ranging from 0 to 10. The participants' history of HZ vaccination was queried, and if none, they were asked about their willingness to receive HZ vaccination in the future. Depending on the respondents' answers about their willingness to receive HZ vaccination, additional questions were posed concerning their reasons for and against receiving the vaccination.

Statistical methods

The patient survey data were analyzed by using PASW Statistics ver. 17.0 (IBM Co., Armonk, NY, USA). To examine the differences in proportions and means, the two-sample t-test was used for continuous variables, and the χ^2 test was used for categorical variables. The relation between age and HZ knowledge was analyzed by using Spearman's rank correlation coefficient. The ANOVA trend test was used to analyze the participants' knowledge according to their educational status. Univariable logistic regression was applied to each variable to identify possible associations with HZ vaccination and willingness to receive the HZ vaccination, and then all characteristics with *p*-values of <0.10 were included in the multivariable logistic regression. We examined the HZ vaccination rate and willingness to receive the HZ vaccination by using multivariable logistic regression analysis while controlling for demographic characteristics (sex, age, educational status, residence area, personal history of HZ, and family history of HZ) and attitudinal characteristics (HZ knowledge and awareness, HZ vaccination history, and willingness to receive the HZ vaccination). Except where stated otherwise, the data were presented as mean \pm standard deviation (SD) or % values, and the cutoff for statistical significance was set at *p* < 0.05.

RESULTS

Sample characteristics

A total of 607 participants (41.6% male and 58.4% female) took part in this survey; their demographic characteristics are presented in Table 1 (n varies between items because of missing data). The mean age of the participants was 47.3 ± 15.8 years (range, 13~88 years). Most participants were older than 50 years; the age distribution was as follows: 10~19 years, n=5 (0.8%); 20~29 years, n=105 (17.5%); 30~39 years, n=91 (15.2%); 40~49 years, n=87 (14.5%); 50~59 years, n=166 (27.7%); 60~69 years, n=109 (18.2%); 70~79 years, n=24 (4.0%); and ≥ 80 years, n=13 (2.2%). With respect to residence, most patients (n=502, 82.8%) lived in an urban area, whereas the remaining 104 (17.2%) lived in rural areas. The educational statuses of lower than middle school, lower than high school, lower than college, and higher than graduate school were reported by 74 (12.2%), 203 (33.6%), 260 (43.0%), and 68 (11.2%) patients, respectively. We surveyed the medical history of the participants, allowing them to specify more than one condition. There were 128 participants with cardiovascular disease, 53 with diabetes, 31 with cancer, 114 with gastrointestinal disease, and 17 with renal disease (Fig. 1). A history of HZ was present in 14.7% of 606 respondents. Among responders who are 50 years of age or older, 21.2% (66 patients) responded about having a history of HZ. Of those with a medical history of more than three conditions, 12 (67.0%) had a history of HZ. One hundred sixty-nine of all 602 respondents (28.1%) had a family history of HZ.

Table 1. Demographic characteristics of the participants

Characteristic	Total sample of participants (n=607)*
Age (yr)	47.3 ± 15.8
10~19	5 (0.8)
20~29	105 (17.5)
30~39	91 (15.2)
40~49	87 (14.5)
50~59	166 (27.7)
60~69	109 (18.2)
70~79	24 (4.0)
≥ 80	13 (2.2)
Sex	
Male	251 (41.6)
Female	353 (58.4)
Living area	
Urban	502 (82.8)
Rural	104 (17.2)
Education	
\leq Middle school	74 (12.2)
\leq High school	203 (33.6)
\leq College	260 (43.0)
\geq Graduate school	68 (11.2)
Family history of HZ	
Yes	169 (28.1)
No	433 (71.9)
Past history of HZ	
Yes	89 (14.7)
No	517 (85.3)
Knowledge [†]	42.3 ± 25.3

Values are presented as mean \pm standard deviation or number (%). HZ: *herpes zoster*. *n varies between items because of missing data. [†]Percentage of correct answers.

(43.0%), and 68 (11.2%) patients, respectively. We surveyed the medical history of the participants, allowing them to specify more than one condition. There were 128 participants with cardiovascular disease, 53 with diabetes, 31 with cancer, 114 with gastrointestinal disease, and 17 with renal disease (Fig. 1). A history of HZ was present in 14.7% of 606 respondents. Among responders who are 50 years of age or older, 21.2% (66 patients) responded about having a history of HZ. Of those with a medical history of more than three conditions, 12 (67.0%) had a history of HZ. One hundred sixty-nine of all 602 respondents (28.1%) had a family history of HZ.

Awareness of HZ and its severity

The participants (n=607) were asked if they had ever heard of HZ; most (n=517, 85.4%) responded that they were aware of HZ (Table 2). The patients scored the severity of their diseases on a range from 1 to 5: cancer and

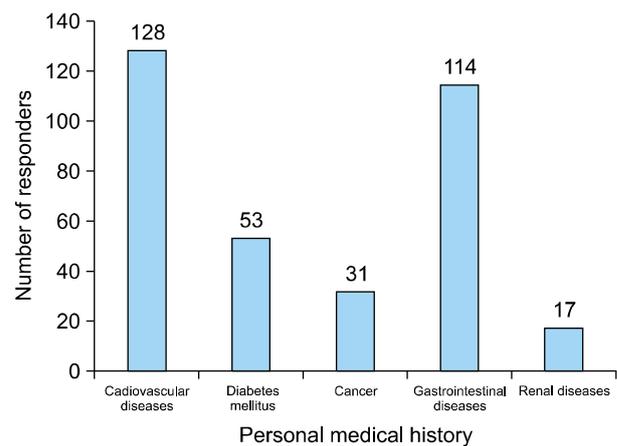


Fig. 1. Past illnesses of the participants.

Table 2. Awareness of and intention to receive *herpes zoster* (HZ) vaccination

Categorical variable	Total sample of participants (n=607)*
Awareness of HZ	
Yes	517 (85.4)
No	88 (14.6)
HZ vaccination	
Yes	36 (6.0)
No	562 (94.0)
Intention to vaccination [†]	
Yes	340 (58.3)
No	243 (41.7)

Values are presented as number (%). *n varies between items because of missing data. [†]Intention to receive HZ vaccination among participants not currently vaccinated.

cerebral diseases were scored highest, followed by cardiac diseases, diabetes mellitus, hypertension, HZ, and atopic dermatitis. The severity scores of HZ were distributed as follows: 1, 45 patients (7.7%); 2, 77 patients (13.2%); 3, 203 patients (34.7%); 4, 132 patients (22.6%); 5, 98 patients (16.8%); and "do not know of HZ," 30 patients (5.1%). Thus, most of the patients scored HZ with more than moderate disease severity (74.0% of patients assigned HZ with a score of ≥ 3).

Pain of HZ

The symptoms perceived to be the least tolerable among the patients with a history of HZ were acute pain and itching sensation (47 patients), followed by PHN (32 patients), acute vesicles and rash (19 patients), sensory disturbance (7 patients), and postherpetic scar and infections (5 patients) (Fig. 2). The VAS for the severity of pain, which was completed by 92 patients, was 7.0 ± 2.6 (mean \pm SD). Most complaints were of greater than moderate pain, with 77 patients (83.7%) assigning a VAS score of > 5 (Fig. 3).

Knowledge of HZ and its vaccination

The percentage of correct answers to questions about HZ and its vaccine was $42.3 \pm 25.3\%$. Women had more knowledge of HZ than men ($45.2 \pm 24.4\%$ vs. $38.0 \pm 25.7\%$, $p=0.0006$). The rate of correct answers did not differ significantly between those who lived in urban areas ($42.6 \pm 25.6\%$) and those who lived in rural areas ($40.3 \pm 23.8\%$, $p=0.239$). Those who had a family history of HZ appeared to know more about HZ than those without (rate of correct answers: $49.1 \pm 20.8\%$ vs. $39.8 \pm 26.4\%$, $p<0.0001$), and those with a personal history of HZ had greater knowledge than those without (rate of correct answers: $49.4 \pm 19.2\%$ vs. $41.0 \pm 26.0\%$, $p=0.0005$). The amount of knowledge about

HZ decreased with increasing age ($r = -0.18$, $p<0.001$). The analysis of the trend of knowledge relative to educational status revealed that those with a higher educational status had greater knowledge about HZ and its vaccine ($p<0.0001$).

Acceptability of HZ vaccine

Among the responders ($n=598$), only 36 (6.0%) had received the HZ vaccine (Table 2); only 28 of those aged > 50 years (9.0%) had received the vaccination. Univariate logistic regression analyses revealed that a personal history of HZ, a family history of HZ, awareness of HZ, increasing age, and greater knowledge about HZ and its vaccine were significantly and positively associated with vaccine acceptability ($p=0.0004$, 0.0622 , 0.0685 , 0.0011 , and 0.0289 , respectively; Table 3). When these significant demographic variables were entered into a multivariate model, age, history of HZ, and knowledge remained as significant predictors, such that those with a history of HZ were 2.23 times more likely to accept the vaccine than those without a history (95% confidence interval [CI], $1.03 \sim 4.83$). The vaccination rate increased with increasing age (odds ratio [OR], 1.05 ; 95% CI, $1.02 \sim 1.07$) and knowledge (OR, 1.02 ; 95% CI, $1.00 \sim 1.03$) (Table 3).

Willingness to receive HZ vaccination

Among those who had not been vaccinated ($n=583$), 58.3% (340 patients) were interested in receiving the vaccination (Table 2). Univariate logistic regression analysis showed that awareness of HZ, increasing age, living in urban areas, and greater knowledge about HZ and its vaccine were significantly and positively associated with willingness to receive the vaccination ($p=0.0003$, 0.0763 ,

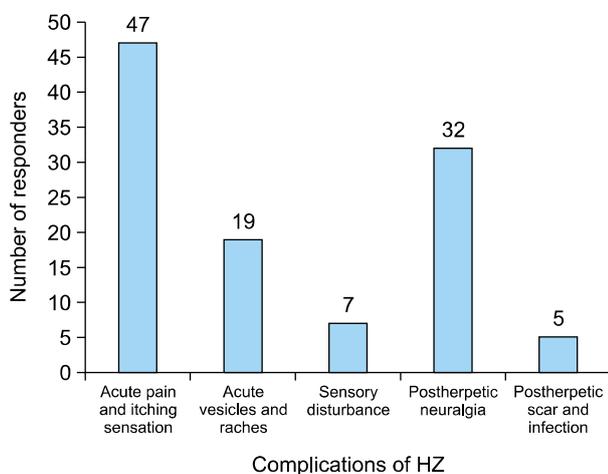


Fig. 2. The least tolerable complications of herpes zoster (HZ).

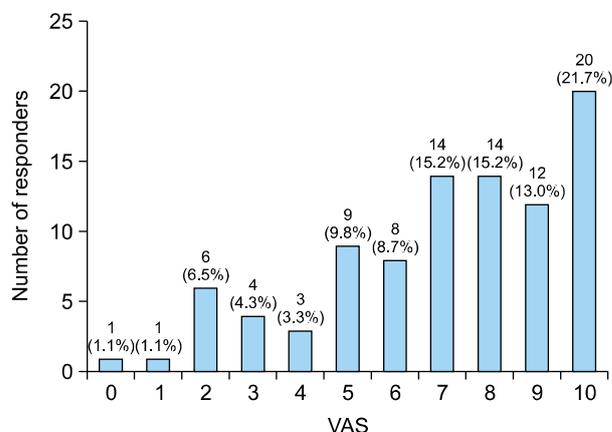


Fig. 3. Visual analogue scale (VAS) for pain associated with herpes zoster (HZ) infection among participants with past history of HZ.

Table 3. Factors associated with *herpes zoster* (HZ) vaccination among the participants

Variable	Univariable logistic regression		Multivariable logistic regression [†]	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age	1.04 (1.02~1.06)	0.0011	1.05 (1.02~1.07)	0.0010
Sex				
Male	1.13 (0.57~2.23)	0.7221		
Female	1.000			
Living area				
Urban	1.30 (0.49~3.42)	0.6003		
Rural	1.000			
Education				
≤Middle school	0.74 (0.21~2.54)	0.9296		
≤High school	0.60 (0.21~1.68)	0.5327		
≤College	0.59 (0.22~1.59)	0.4788		
≥Graduate school	1.000			
Family history of HZ				
Yes	1.93 (0.97~3.83)	0.0622	1.27 (0.61~2.63)	0.5253
No	1.000			
Past history of HZ				
Yes	3.73 (1.81~7.68)	0.0004	2.23 (1.03~4.83)	0.0419
No	1.000			
Knowledge*	1.02 (1.00~1.03)	0.0289	1.02 (1.00~1.03)	0.0324
Awareness of HZ				
Yes	6.42 (0.87~47.46)	0.0685	4.62 (0.60~35.76)	0.1424
No	1.000			

OR: odds ratio, CI: confidence interval. *Percentage of correct answers. [†]Multivariate logistic regression analysis controlling for the effects of age, family history of HZ, past history of HZ, knowledge about HZ, and HZ awareness.

0.0853, and <0.0001, respectively). When these significant demographic variables were entered into a multivariate model, age, awareness of HZ, and knowledge remained as significant predictors, such that those with awareness of HZ were 1.80 times more likely to be willing to be vaccinated for HZ than those without (95% CI, 1.09~2.97). The willingness to receive vaccination for HZ increased significantly with age (OR, 1.02; 95% CI, 1.00~1.03) and knowledge (OR, 1.01; 95% CI, 1.01~1.02) (Table 4).

Reason for vaccination

The patients were asked for the reasons underlying their willingness to receive the HZ vaccination; the most frequent answer was "severe sequelae" (114 responders), followed by "knowing someone who has HZ" (81 responders), "recommendation from a doctor or other health-care professional" (80 responders), "information from the mass media" (59 responders), and "suggestion from family or someone around me" (26 responders). A small number of participants responded with "already had an HZ history," "have poor immunity," and "do not want pain." The most common reason underlying an unwillingness to receive the vaccination was "the expensive cost of the vaccine"

(123 responders), followed by "did not feel the need since no one around me is vaccinated" (114 responders), "I'm healthy enough" (102 responders), "lack of knowledge on the disease" (71 responders), and "doctors did not recommend the vaccine" (30 responders). A small number responded with "did not know that the vaccine exists," "doubtful about the efficacy of the vaccine," and "concerns about postvaccine complications."

DISCUSSION

In the present study, we investigated the awareness of HZ, knowledge about HZ and its vaccine, and the HZ vaccination rate among a sample of participants attending six different university dermatology clinics in Korea, and analyzed the predictors of HZ vaccination. Most studies have found that the observed increases in the incidence of HZ during the past decade have occurred in the absence of national HZ vaccination programs⁷⁻¹³. Among our sample, 14.7% of all respondents had a history of HZ, and 21.2% (66 of 312) of those aged ≥50 years had a history of HZ. Choi et al.¹² reported that the disease burden of HZ is considerably higher in Korea than in other countries, and the reason for this disparity appears to be related to an in-

Table 4. Factors associated with intention to have *herpes zoster* (HZ) vaccination among participants not currently vaccinated

Categorical variables	Univariable logistic regression		Multivariable logistic regression [†]	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age	1.01 (1.00~1.02)	0.0763	1.02 (1.00~1.03)	0.0107
Sex				
Male	0.88 (0.63~1.23)	0.4470		
Female	1.000			
Living area				
Urban	0.67 (0.43~1.06)	0.0853	0.66 (0.42~1.06)	0.0850
Rural	1.000			
Education				
≤Middle school	0.79 (0.39~1.58)	0.9245		
≤High school	0.69 (0.38~1.24)	0.4356		
≤College	0.65 (0.37~1.16)	0.2202		
≥Graduate school	1.000			
Family history of HZ				
Yes	1.30 (0.90~1.89)	0.1634		
No	1.000			
Past history of HZ				
Yes	1.24 (0.77~1.99)	0.3880		
No	1.000			
Knowledge*	1.01 (1.01~1.02)	<0.0001	1.01 (1.01~1.02)	0.0001
Awareness of HZ				
Yes	2.38 (1.49~3.81)	0.0003	1.80 (1.09~2.97)	0.0216
No				

OR: odds ratio, CI: confidence interval. *Percentage of correct answers. [†]Multivariate logistic regression analysis controlling for the effects of age, living area, knowledge about HZ, and HZ awareness.

crease in the ratio of the elderly population to the total population, and in the incidence and treatment of chronic diseases that weaken the immune system. As shown above, our results once again support the high incidence of HZ in Korea. These given circumstances call for direct measures. The least tolerable symptom for most of the present patients with a history of HZ was pain (acute and PNH), with a VAS pain severity score of 7.0 ± 2.6 . Consistent with previous studies, HZ-related pain was associated with marked reductions in health-related quality of life (HRQoL) in both the acute phase and in patients with persistent pain¹⁴⁻¹⁷. In addition, those with more severe HZ-related pain appear more likely to also report symptoms of anxiety and depression^{16,18}. Many studies have shown that despite early diagnosis and treatment with antiviral agents, many HZ patients experience persistent pain and a significant long-term reduction in HRQoL¹⁹. It is necessary to reinforce education programs concerning the effect of HZ and HZ-related pain to improve the HRQoL in these patients. The participants' knowledge about HZ and its vaccine was low, with less than half of the questions being answered correctly ($42.3 \pm 25.3\%$). The female participants achieved a higher rate of correct answers, indicating that the men were less interested and informed about the disease.

Knowledge about the disease was also lower among those with lower levels of education and older age. Therefore, it seems that efforts should be made to better educate men, the elderly, and those with lower levels of education about HZ and its vaccination.

It has been demonstrated in multiple clinical studies that HZ vaccination reduces the incidence of HZ and PHN, as well as the associated health-care costs². However, in the present study, the HZ vaccination rate was very low overall, with only 9.0% of those aged ≥ 50 years (an indication for HZ vaccine) having been vaccinated against HZ. These results are similar to those reported by Javed et al.²⁰ (11.5%), and are considerably lower than for other preventative vaccines. We found that the HZ vaccination rate was 2.23 times higher in patients with a history of HZ (95% CI, 1.03~4.83). It seems that the debilitating sequelae of HZ, such as severe pain, may have increased the demand for vaccination among these patients. The association between a history of HZ and the vaccination rate provides further support about the necessity for HZ vaccination. In addition, greater knowledge of HZ and its vaccine was associated with a higher vaccination rate. It seems to be necessary to educate the public about the disease and its vaccination if we are to increase the vacci-

nation uptake rate.

Among those who had not been vaccinated, 58.3% expressed willingness to receive HZ vaccination in the future. The most frequent reason was "severe sequelae," followed by "knowing someone who has HZ" and "recommendation from a doctor or other health-care professionals." Overall, this indicates that education about the disease and its sequelae by health professionals including doctors can help motivate patients to accept HZ vaccination.

The key reason cited by most of the respondents who did not want to receive HZ vaccination was the high cost. The cost of the HZ vaccine has been reported previously to be a major obstacle to vaccination efforts²¹. However, most studies have shown that vaccination against HZ is likely to be cost-effective²². Kawai et al.²² conducted a review of 15 cost-effectiveness studies in North America and Europe and concluded that most studies showed that vaccination against HZ is cost-effective. Although there is a dearth of Korean data on cost-effectiveness, the cost-effectiveness of HZ vaccination can be expected to be high given the disease duration of HZ and both social and medical costs associated with PHN. Emphasizing this point to patients and the provision of systematic financial support, such as insurance coverage, would be effective in increasing the HZ vaccination rate.

The limitation of this study was that we targeted participants who visited dermatology clinics, most of which were located in urban areas, and most of the patients were residents of these urban areas. Therefore, larger studies are needed to enable generalization of the findings to all populations in Korea.

There is a dearth of research examining the vaccination rate of HZ and predictors of HZ vaccination in Korea. The main objective of the present investigation is to identify the demographic or attitudinal factors affecting the acceptability of HZ vaccination in Korea. We believe that the data presented in this study will contribute to improving the HZ vaccination rate and reducing the socioeconomic costs incurred by this debilitating but preventable disease. In conclusion, awareness of the severity of the complications associated with HZ was an important motivator for vaccination, as well as the recommendations of doctors or health-care professionals for vaccination. In addition, this survey indicates that patients consider cost as a major barrier to receiving vaccination. Thus, encouraging doctors and health-care professionals to educate their patients about the disease and to recommend the vaccination, together with the provision of insurance coverage for HZ vaccination, could improve the vaccine's acceptability.

ACKNOWLEDGMENT

This work was supported by the Konkuk University.

REFERENCES

1. Langan SM, Smeeth L, Margolis DJ, Thomas SL. Herpes zoster vaccine effectiveness against incident herpes zoster and post-herpetic neuralgia in an older US population: a cohort study. *PLoS Med* 2013;10:e1001420.
2. Oxman MN, Levin MJ, Johnson GR, Schmader KE, Straus SE, Gelb LD, et al; Shingles Prevention Study Group. A vaccine to prevent herpes zoster and postherpetic neuralgia in older adults. *N Engl J Med* 2005;352:2271-2284.
3. Gilden DH. Varicella-zoster virus vaccine—grown-ups need it, too. *N Engl J Med* 2005;352:2344-2346.
4. Hurley LP, Harpaz R, Daley MF, Crane LA, Beaty BL, Barrow J, et al. National survey of primary care physicians regarding herpes zoster and the herpes zoster vaccine. *J Infect Dis* 2008;197 Suppl 2:S216-S223.
5. European Medicines Agency. ZOSTAVAX Product Information [Internet]; c2013 [cited 2013 Mar 27]. Available from: http://www.ema.europa.eu/docs/en_GB/document_library/EPAR_-_Product_Information/human/000674/WC500053462.pdf.
6. Hensley S, NPR. FDA gives OK to broader use of shingles vaccine [Internet]. Available from: www.npr.org/blogs/health/2011/03/25/134849776/zostavax-fda-gives-ok-to-broader-use-of-shingles-vaccine.
7. Weinberg JM. Herpes zoster: epidemiology, natural history, and common complications. *J Am Acad Dermatol* 2007;57 (6 Suppl):S130-S135.
8. Brisson M, Edmunds WJ, Law B, Gay NJ, Walld R, Brownell M, et al. Epidemiology of varicella zoster virus infection in Canada and the United Kingdom. *Epidemiol Infect* 2001; 127:305-314.
9. Russell ML, Schopflocher DP, Svenson L, Virani SN. Secular trends in the epidemiology of shingles in Alberta. *Epidemiol Infect* 2007;135:908-913.
10. Pérez-Farinós N, Ordoñas M, García-Fernández C, García-Comas L, Cañellas S, Rodero I, et al. Varicella and herpes zoster in Madrid, based on the Sentinel General Practitioner Network: 1997-2004. *BMC Infect Dis* 2007;7:59.
11. Chao DY, Chien YZ, Yeh YP, Hsu PS, Lian IB. The incidence of varicella and herpes zoster in Taiwan during a period of increasing varicella vaccine coverage, 2000-2008. *Epidemiol Infect* 2012;140:1131-1140.
12. Choi WS, Noh JY, Huh JY, Jo YM, Lee J, Song JY, et al. Disease burden of herpes zoster in Korea. *J Clin Virol* 2010;47:325-329.
13. Toyama N, Shiraki K; Society of the Miyazaki Prefecture Dermatologists. Epidemiology of herpes zoster and its relationship to varicella in Japan: a 10-year survey of 48,388 herpes zoster cases in Miyazaki prefecture. *J Med Virol* 2009;81:2053-2058.
14. Drolet M, Brisson M, Schmader KE, Levin MJ, Johnson R, Oxman MN, et al. The impact of herpes zoster and posthe-

- herpetic neuralgia on health-related quality of life: a prospective study. *CMAJ* 2010;182:1731-1736.
15. Chidiac C, Bruxelles J, Daures JP, Hoang-Xuan T, Morel P, Lepège A, et al. Characteristics of patients with herpes zoster on presentation to practitioners in France. *Clin Infect Dis* 2001;33:62-69.
 16. Oster G, Harding G, Dukes E, Edelsberg J, Cleary PD. Pain, medication use, and health-related quality of life in older persons with postherpetic neuralgia: results from a population-based survey. *J Pain* 2005;6:356-363.
 17. Weinke T, Edte A, Schmitt S, Lukas K. Impact of herpes zoster and post-herpetic neuralgia on patients' quality of life: a patient-reported outcomes survey. *Z Gesundh Wiss* 2010;18:367-374.
 18. Schmader K, Gnann JW Jr, Watson CP. The epidemiological, clinical, and pathological rationale for the herpes zoster vaccine. *J Infect Dis* 2008;197 Suppl 2:S207-S215.
 19. Bouhassira D, Chassany O, Gaillat J, Hanslik T, Launay O, Mann C, et al. Patient perspective on herpes zoster and its complications: an observational prospective study in patients aged over 50 years in general practice. *Pain* 2012;153:342-349.
 20. Javed S, Javed F, Mays RM, Tyring SK. Herpes zoster vaccine awareness among people ≥ 50 years of age and its implications on immunization. *Dermatol Online J* 2012;18:2.
 21. Lee TJ, Hayes S, Cummings DM, Cao Q, Carpenter K, Heim L, et al. Herpes zoster knowledge, prevalence, and vaccination rate by race. *J Am Board Fam Med* 2013;26:45-51.
 22. Kawai K, Preaud E, Baron-Papillon F, LARGERON N, Acosta CJ. Cost-effectiveness of vaccination against herpes zoster and postherpetic neuralgia: a critical review. *Vaccine* 2014;32:1645-1653.