

Public Acceptance and Willingness to Hepatitis A Vaccination in Children Aged 7-18 Years in Republic of Korea

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Hepatitis A can cause serious illness among adolescents and adults with low vaccination coverage. Even though hepatitis A vaccine is one of the strong candidates for Korean national immunization program, adolescents aged older than 12 yr would not benefit. Our purpose was to assess the willingness and analyze the correlates of Korean mothers for hepatitis A (HepA) vaccination to develop strategies for HepA vaccination. A national telephone survey on 800 mothers with children aged 7-18 yr was conducted with random-digit dialing method. Sixty-two percent and 92% of the mothers reported that they were willing to HepA vaccination at current cost and at half of the current cost, respectively. However, at current cost, only 79% wished to vaccinate their child in an epidemic and 32% wished to vaccinate promptly. Having two or more children, not having future plans to send the child overseas, and low family income were significantly associated with not willing to HepA vaccination. Low perception of the susceptibility for hepatitis A and perception of the current cost as barrier increased the odds of unwillingness to vaccination at current cost and to prompt vaccination. The mothers' willingness to HepA vaccination for the children aged 7-18 yr in Korea was not very high at current cost and associated socioeconomic status and health-belief. Targeted intervention or strategies are needed to increase the HepA vaccination rate among children in Korea.

Keywords: Hepatitis A; Vaccination; Willingness; Children; Adolescent

INTRODUCTION

Hepatitis A virus (HAV) causes acute viral hepatitis characterized by anorexia, nausea and vomiting, low grade fever, malaise, myalgia, headache, and jaundice. HAV is transmitted by the fecal-oral route through person-to-person contact or contaminated food and water (1). While HAV infections among young children aged 6 yr or less are asymptomatic in about 70% of cases, it is more symptomatic and may result in even severe illness among adolescents and adults, resulting in substantial increase in direct medical cost and indirect loss of productivity at school and work.

Hepatitis A vaccines have been developed since the end of the 1980s and several inactivated vaccines are currently available globally. They are all highly protective and can reduce the burden of hepatitis A disease and have similar side-effects (2, 3). National recommendation for hepatitis A immunization varies according to the local context including the proportion of the susceptible population and the chance of exposure to HAV. In many countries, especially with low endemicity, hepatitis A (HepA) vaccination is recommended only for persons at high risk - those who are planning to travel to or live in the area where hepatitis A is widespread or have any chronic liver diseases or

hemophilia, men who have sex with men, workers with primates or in institutions with poor personal hygiene (2-4). On the other hand, some countries including Argentina, Israel, and the United States of America have included the vaccine in their routine childhood immunizations. The Advisory Committee on Immunization Practices (ACIP) first recommended HepA vaccination only to travelers to HAV endemic countries in 1996, then expanded it to all children at 12 months of age in 2006 (5-8). In addition, it is recommended that the catch-up vaccination of unvaccinated children aged 2-18 yr and HepA vaccination for any person wishing to obtain immunity should be considered.

In Republic of Korea, HAV is still the most common cause of acute viral hepatitis (~80%). The incidence of hepatitis A in Korea had been decreased rapidly late in the 1980s and early in the 1990s. However, it has increased especially among young adults and adolescents in the 2000s with the peak of 15,231 patients reported in 2009 (9). Hepatitis A vaccine was first introduced in 1997 and now four types of hepatitis A vaccines were available in Korea. The Korea Centers for Disease Control and Prevention recommends the routine 2-doses of HepA vaccination at 6-12 months intervals to the children or high-risk adults but it is not included in the national immunization program (NIP) yet. Thus parents have to pay approximately 100,000 Ko-

rean won (KRW) out-of-pocket (approximately 94 USD) for the 2-doses per child. The vaccination coverage among children aged 1-2 yr is estimated at 40% in 2006 (9, 10). In 2009, the seroprevalence was 50%-60% among children aged less than 10 yr which was attributed to vaccination since 1998. However, the vaccination coverage is less than 25% among adolescents and those in their 20s.

The Korean Pediatric Society also has recommended HepA vaccination for children aged 12-24 months and an economic analysis of HepA vaccination showed that the intervention achieving vaccination coverage of 90% for 1 yr old is a cost-effective strategy in a societal perspective (11). Recently HepA vaccination is the one of the strong candidates as NIP for children in Korea (12-14). However, Korean NIP for children provides vaccines free of charge only to children aged 12 yr or less in practice and thus HepA vaccination for adolescents may be a different issue. Understanding the public attitudes towards hepatitis A and HepA vaccination among parents of the adolescents, and its correlates would be indispensable for developing the optimal strategy to increase the vaccination rate and rapid decrease in the incidence of hepatitis A.

Therefore, we aimed to assess the public attitudes and willingness and analyze the correlates to HepA vaccination among mothers with children aged 7-18 yr in Korea.

MATERIALS AND METHODS

Study population and survey sampling

A telephone-based survey on the mothers of 800 non-institutionalized Korean children aged 7-18 yr was conducted in May, 2013. A proportional quota sampling method was applied for participants to be recruited according to the distribution of two age groups (7-12, and 13-19 yr) in 15 residential areas. Eight hundred interviews were conducted using a random-digit dialing method of household telephone numbers. We made random calls and asked if they had children aged 7-18 yr, then the interview was continued only on the mothers aged 60 yr or less and not having vaccinated her child with HAV vaccine. If they had more than one child, we asked them to answer about the eldest one among their children aged 7-18 yr. The overall response rate was 23.5%. Verbal informed consent for participation in survey was obtained before beginning the telephone interview.

Measurements

The survey instrument was a thirty-item questionnaire about parental attitudes toward HepA vaccination and the potentially associated factors such as sociodemographic characteristics, and their health-belief on hepatitis A and HepA vaccination.

Parental willingness of HepA vaccination was primarily measured by mother's "Yes" response to the question "If the 2-dose HAV vaccination costs 100,000 KRW (about 94 USD) at the cur-

rent level (or in the question for the other condition, 40,000 KRW, approximately half the current level), are you willing to vaccinate the child?" Then we asked the willingness to HepA vaccination at five differential scenarios; vaccination free of charge under the NIP, an epidemic nearby, plan for travel to the countries with endemic HAV, preparation for the group life, and promptly. The responses were quantified using an 11-point scale ranging from 0 (never) to 10 (certainly). The willingness score for prompt vaccination was classified into the score of 10 ("I would certainly get the child vaccinated as soon as possible.") and the less, then the willingness of the score of 10 to prompt vaccination was used in further analysis.

As potential correlates for the willingness towards HepA vaccination, demographic characteristics of mother (age, education, and working status) and children (sex and age of the corresponding child, total number of children in family) and information on the family characteristics (mother's current living with fathers, monthly household income, Family member's travel overseas, plan to send the child overseas for academic, vocational, or any other reasons, and the experiences of hepatitis A and HepA vaccination around them such as neighborhood, relatives, friends, or colleagues) were surveyed. The health-belief on hepatitis A and HepA vaccination were asked using the response options of a five-point Likert scale: very likely (a score of 5), likely, not likely nor unlikely, unlikely, and very unlikely (a score of 1). Perceived susceptibility was measured by a question about the perceived likelihood of getting hepatitis A for her child. Perceived severity consisted of two questions about the severe health consequence of hepatitis A - the mortality and the absence from work or school. Perceived benefit was measured by a question about the perceived vaccine effectiveness for protection against hepatitis A. As perceived barriers, three questions were asked about current cost of HepA vaccination, the time needed to visit the health care institution for HepA vaccination, and the lack of the knowledge about hepatitis A and HepA vaccination. For each item on perception, the responses were categorized into the two classes of higher perception (likely and very likely, a score of 4 or 5) and lower perception (other responses, a score of 1-3).

Statistical analysis

The descriptive characteristics of the mothers and their willingness to HepA vaccination at each cost and to prompt vaccination (a score of 10) are presented as frequency and percentage. Willingness scores at various hypothetical scenarios and scores of perceived susceptibility, severity, benefit, and barrier were summarized as mean \pm standard deviation. The willingness scores were grouped into subgroups; 1-3, 4-6, 7-9, 10 and the perception scores were divided into two groups; ≥ 4 and < 4 . And their distributions were presented as frequency and percentage. The scores and the proportions of the willingness of a

score of 10 across the scenarios were compared with Friedman test and Cochran's Q test, respectively. If the overall test was significant, all pairwise comparisons were conducted using Bonferroni adjustment.

The willingness to HepA vaccination at two costs and to prompt vaccination according to the family characteristics and the experiences and the health-belief on hepatitis A or HepA vaccination, was presented as the percentage and compared with chi-square test. To assess the independent association of each factors with not being willingness to vaccinate the child against HAV, multiple logistic regression analysis were conducted. Since the health-belief and the experiences of hepatitis A and HepA vaccination could be intervening variables between willingness to HepA vaccination and other sociodemographic characteristics, we used two types of models: first models including only variables of the family characteristics at the start and second models including the variables about the experience and the health-belief additionally. For considering the possible close correlation between variables, we used backward variable selection method in multiple logistic regression analysis. All statistical analyses were performed using SAS package (version 9.2, SAS institute, Cary, NC, USA). The *P* value < 0.05 was considered significant.

Ethics statement

This study was approved by the institutional review board of Ewha Womans University Mokdong Hospital (IRB No.13-10A-11). Verbal consent on study participation was received from the interviewed mothers via telephone but this was not recorded.

RESULTS

The demographic characteristics are described in Table 1. Two thirds of the mothers were in the age group 40-49 yr and about half of them were housewives and had a monthly household income of 3-4.99 million KRW, and about 20% had that of less than 3 million KRW. More than half were educated to college level or higher and most of them had 2 or more children (81.5%). About two thirds had a family member who had travelled abroad and the plan to send the child overseas.

The willingness toward HepA vaccination at various scenarios

When asked to the question with binary response on willingness to HepA vaccination, 68.4% of the mothers reported that they were willing to vaccinate their child against hepatitis A at current cost (100,000 KRW for two shots) and 91.8% reported they would vaccinate their child if the HepA vaccination would cost less than half of the current price (40,000 KRW) (Table 1). The distributions of the mother's willingness scores to HepA vaccination at various hypothetical scenarios are presented in

Table 2. If HepA vaccination were to be free, the mean score of the willingness to HepA vaccination was 9.6 ± 1.4 and the proportion of those who reported to get the child vaccinated certainly (a score of 10) was 91.5%. In contrast, the mean score and the proportion of a score of 10 were about 9 and 78% in assumptive situations of an epidemic nearby, the travel to the HAV endemic area, and 8.1 ± 2.6 and 51.5% for the group life admission. The mothers who reported to vaccinate the child promptly were only 32.1% and the mean score was 6.5 ± 3.2 . The willingness scores and the proportions of a score of 10 across the different scenarios were significantly different (both *P* < 0.001; also significant in all pairwise comparisons except between the epidemic around them and the travel to the HAV endemic area).

The willingness toward HepA vaccination according to the family characteristics

Mothers' willingness toward HepA vaccination according to the family characteristics at three different situations was presented in Table 1. At current cost, more mothers with a monthly family income > 3 million KRW and those whose family members had travelled overseas were more willing towards HepA vaccination compared to others by greater than ten percentage points. Mothers who had the plan to send the child abroad were much more likely to get the child vaccinated than those who did not (77.5% compared to 54.3%). More mothers living in Seoul or with only one child were willing towards HepA vaccination compared to others. At a lower cost of 40,000 KRW, more mothers (91.8%) were willing to HepA vaccination and the differences in the proportion of the willingness between subgroups were less (about 5%-10% points) than at current cost of the HepA vaccination. However, the differences were still statistically significant. For the willingness for prompt vaccination, no demographic characteristics of the family made a difference.

The personal experiences and the health-belief on hepatitis A or HepA vaccination

The personal experiences and the health-belief on hepatitis A or HepA vaccination are presented in Table 3. Eighty nine percent of the mothers had heard about hepatitis A while those who had an experience of hepatitis A or HepA vaccination around them were only 11% and 26%, respectively. Health-belief on hepatitis A and HepA vaccination demonstrates that the mothers who perceived hepatitis A as severe for loss of school or work were 75% and those with a high perceived susceptibility for her child to get hepatitis were 55%. The mothers who perceived the benefit of the HepA vaccination great and those who perceived current cost as a barrier were both about 62%. The perception of each constructs of the health-belief and the experiences related to hepatitis A or HepA vaccination was significantly associated with the willingness to HepA vaccination at current cost and at a lower cost. For the willingness for prompt vaccination,

Table 1. Demographic characteristics of the families and the mothers' willingness towards hepatitis A vaccination

Characteristics	No. (%)	At current cost*		At lower cost†		Prompt vaccination‡	
		%	P	%	P	%	P
Total	800	68.4		91.8		32.1	
Mother's age (yr)			0.84		0.45		0.09
< 40	223 (27.9)	69.5		93.7		31.4	
40-49	522 (62.5)	68.2		91.0		31.0	
50-59	55 (6.9)	65.4		90.9		45.5	
Mother's working status			0.82		0.80		0.10
Full-time worker	288 (36.0)	67.4		91.3		35.4	
Part-time worker	132 (16.5)	70.5		93.2		35.6	
Housewives	380 (47.5)	68.4		91.6		28.4	
Mother's education level			0.10		0.80		0.46
High school or less	301 (37.6)	64.5		91.7		33.9	
College	453 (56.6)	69.8		91.8		30.7	
Higher than college	39 (4.9)	82.1		92.3		38.5	
Refused to respond	7 (0.9)	71.4		85.7		14.3	
Residential area			0.037		0.82		0.14
Seoul	144 (18.0)	77.1		91.0		29.2	
Metropolitans	214 (26.8)	68.2		91.1		28.0	
Other areas	442 (55.3)	65.6		92.3		35.1	
Currently living with the spouse			0.64		0.36		0.11
Yes	761 (95.1)	68.2		92.0		32.7	
No	39 (4.9)	71.8		87.2		20.5	
Monthly family income (million KRW)			0.003		< 0.001		0.77
Less than 2	64 (8.0)	59.4		87.5		39.1	
2-2.99	95 (11.9)	56.8		84.2		33.7	
3-3.99	186 (23.3)	70.4		97.9		31.7	
4-4.99	169 (21.1)	73.4		94.1		31.4	
More than 5	239 (29.9)	73.2		92.1		31.8	
Refused to respond	47 (5.9)	53.2		78.7		25.5	
Family member's travel abroad			< 0.001		0.021		0.72
Yes	516 (64.5)	72.9		93.4		32.6	
No	284 (35.5)	60.2		88.7		31.3	
Plan to send the child overseas			< 0.001		< 0.001		0.29
Yes	485 (60.6)	77.5		94.6		30.7	
No	315 (39.4)	54.3		87.3		34.3	
Total number of children in family			< 0.001		0.060		0.48
1	148 (18.5)	81.8		95.3		35.8	
2	486 (60.8)	66.7		92.0		30.7	
≥ 3	166 (20.8)	61.5		88.0		33.1	
Child's age (yr)			0.88		0.31		0.14
7-12	351 (43.9)	68.7		92.9		29.3	
13-18	449 (56.1)	68.2		90.9		34.3	
Child's sex			0.74		0.13		0.78
Boy	399 (49.9)	68.9		93.2		32.6	
Girl	401 (50.1)	67.8		90.3		31.7	

*At current cost: 100,000 Korean won (KRW) (about 94 USD); †At the lower cost: 40,000 KRW; ‡Like the coming weekend or the coming vacation.

more mothers with a higher perceived susceptibility and a lower perception of current cost as a barrier were willing to vaccinate their child promptly than others.

The factors associated with unwillingness to HepA vaccination

To assess the correlates associated with unwillingness to vaccinate the child against hepatitis A at two costs and prompt vaccination, two logistic regression models with backward variable selection method were used for each outcome: each model 1 including only the variables about sociodemographic characteristics of the families and each model 2 including the variables

about the experience and the health-belief on hepatitis A and HepA vaccination additionally (Table 4). In the first model for the willingness to HepA vaccination at current cost, having 2 or more children compared to having only one child was significantly associated with unwillingness to HepA vaccination (OR, 2.36 for two; OR, 2.85 for three or more children). The mother without plan to send the child abroad had a 2.7 times higher odds of unwillingness to HepA vaccination compared to the others (95% CI, 1.97-3.74). No response to income and monthly family income of less than 3 million KRW was also significantly and marginally significantly associated. In the second model for the willingness at current cost, no personal experience of

HepA vaccination around them, low severity perception for loss of school or work due to hepatitis A, and low susceptibility perception for their child to get hepatitis A increased the odds of not being willing to vaccinate the child by 1.7-1.9 fold while the

mothers who perceived current cost of HepA vaccination as barrier had a 3.2 fold higher odds of unwillingness to HepA vaccination than those who did not (95% CI, 2.20-4.70).

At a lower cost of 40,000 KRW, the family income was more strongly associated with not being willing to vaccinate the child against HAV than at current cost. The mothers with monthly family income of less than 3 million KRW and no response had higher unwillingness ORs of 2.40 and 3.80 compared to those with monthly family income of 3 million KRW or higher (95% CI, 1.34-4.30 and 1.71-8.44, respectively). No plan to send the child overseas was also associated with unwillingness to HepA vaccination, but the number of children in family was not anymore. In the second model, lower susceptibility perception, lower benefit perception, and low barrier perception for current cost and lack of time was associated with the higher odds of not being willing to vaccinate by 1.8-2.2 fold, compared to others.

For not being willing to vaccinate the child against HAV promptly, no family characteristics had a significant association. Only susceptibility perception to get hepatitis A and perception of

Table 2. Willingness score towards hepatitis A vaccination at different hypothetical scenarios

Willingness score	Free vaccination under the NIP	An epidemic nearby*	Plan for the travel to the HAV endemic area	Preparation for the group life	Prompt vaccination [†]
Mean ± SD [‡]	9.6 ± 1.4	9.3 ± 1.7	9.1 ± 2.0	8.1 ± 2.6	6.5 ± 3.2
Median (Q1, Q3)	10 (10,10)	10 (10,10)	10 (10,10)	10 (7,10)	7 (5,10)
Proportion [§] (%)					
10 (certainly)	91.5	78.9	78.3	51.5	32.1
7-9	4.5	12.6	11.8	25.4	20.9
4-6	2.6	0.9	7.0	17.6	30.1
0-3 (never)	1.4	7.6	3.0	5.5	16.9

*Around their home or school; [†]Like the coming weekend or the coming vacation; [‡]Difference in willingness score $P < 0.0001$ (by Friedman test); [§]Difference in the proportions of a score of 10 across the scenarios $P < 0.001$ (by Cochran's Q test). NIP, national immunization program; HAV, hepatitis A virus; SD, standard deviation; Q1, first quartile; Q3, third quartile.

Table 3. Experience and health belief related to hepatitis A, hepatitis A vaccination and the willingness for hepatitis A vaccination

Experience or health-belief	No. (column %)	Willingness of HepA vaccination					
		At current cost*		At lower cost [†]		Prompt vaccination [‡]	
		%	P	%	P	%	P
Experience associated with Hepatitis A or HepA vaccination							
Ever heard about hepatitis A			< 0.001		0.003		0.56
Yes	708 (88.5)	70.5		92.8		31.8	
No	92 (11.5)	52.2		83.7		34.8	
Experience of hepatitis A of myself and neighborhood			0.48		0.68		0.75
Yes	85 (10.6)	71.8		90.6		30.6	
No	715 (89.4)	68.0		91.9		32.3	
Experience of HepA vaccination of myself or neighborhood			0.001		0.017		0.84
Yes	208 (26.0)	77.4		95.7		32.7	
No	592 (74.0)	65.2		90.4		31.9	
Health-belief on hepatitis A and HepA vaccination (mean ± SD)	4.1 ± 1.0		< 0.001		0.16		0.27
Low (< 4)	197 (24.6)	55.8		89.3		28.9	
High (≥ 4)	603 (75.4)	72.5		92.5		33.2	
Perceived severity for mortality	3.6 ± 1.2		< 0.001		0.044		0.14
Low (< 4)	354 (44.3)	62.2		89.6		29.4	
High (≥ 4)	446 (55.8)	73.3		93.5		34.3	
Perceived susceptibility for my child to get hepatitis A	3.6 ± 1.0		< 0.001		0.002		< 0.001
Low (< 4)	359 (44.9)	59.6		87.7		22.3	
High (≥ 4)	441 (55.1)	75.5		95.0		40.1	
Perceived benefit of the HepA vaccination	3.7 ± 1.0		0.020		0.002		0.13
Low (< 4)	307 (38.4)	63.5		88.0		29.0	
High (≥ 4)	493 (61.6)	71.4		94.1		34.1	
Perceived barrier of current expensive cost	3.7 ± 1.2		< 0.001		0.007		0.013
Low (< 4)	305 (38.2)	83.3		95.1		37.4	
High (≥ 4)	495 (61.9)	59.2		89.7		28.9	
Perceived barrier of lack of time for HepA vaccination	2.4 ± 1.2		0.77		0.023		0.66
Low (< 4)	653 (81.6)	68.6		92.8		32.5	
High (≥ 4)	147 (18.4)	67.4		87.1		30.6	
Perceived barrier of lack of knowledge of hepatitis A and HepA vaccination	3.1 ± 1.1		0.21		0.15		0.69
Low (< 4)	537 (67.1)	69.8		92.7		31.7	
High (≥ 4)	263 (32.9)	65.4		89.7		33.1	

*At current cost: 100,000 Korean won (KRW) (about 94 USD); [†]At the lower cost: 40,000 KRW; [‡]Like the coming weekend or the coming vacation. HepA vaccination, hepatitis A vaccination.

Table 4. Factors associated with mothers' willingness to vaccinate the child against hepatitis A according to different hypothetical scenarios

Factors		At current cost*	At lower cost [†]	Prompt vaccination [‡]
		OR (95% CI)	OR (95% CI)	OR (95% CI)
Model including variables related to demographics and family characteristics				
Monthly family income	< 3 million KRW	1.43 (0.97-2.09) [§]	2.40 (1.34-4.30)	
	Refused to respond	1.90 (1.01-3.58)	3.80 (1.71-8.44)	
Total number of children in family	2	2.36 (1.47-3.80)		
	≥ 3	2.85 (1.66-4.89)		
Plan to send the child overseas	No	2.71 (1.97-3.74)	2.03 (1.18-3.47)	
Model additionally including variables related to the health-belief and experience on hepatitis A and hepatitis A vaccination				
Monthly family income	< 3 million KRW	1.20 (0.80-1.79)	2.14 (1.18-3.90)	
	Refused to respond	1.92 (1.00-3.72)	3.50 (1.54-7.99)	
Total number of children in family	2	2.17 (1.32-3.56)		
	≥ 3	2.27 (1.29-4.01)		
Plan to send the child overseas	No	2.57 (1.84-3.60)	1.95 (1.13-3.36)	
Experience of HepA vaccination of me or my neighborhood	No	1.70 (1.14-2.55)		
Severity perception for loss of school or work	Low	1.86 (1.29-2.68)		
Susceptibility perception for my child to get hepatitis A	Low	1.94 (1.39-2.70)	2.24 (1.29-3.90)	2.33 (1.70-3.19)
Benefit perception of the HepA vaccination	Low		1.87 (1.10-3.20)	
Barrier perception of the HepA vaccination due to current expensive cost	High	3.22 (2.20-4.70)	2.03 (1.09-3.79)	1.45 (1.07-1.98)
Barrier perception of the HepA vaccination due to lack of time	High		1.88 (1.04-3.41)	

*At current cost: 100,000 Korean won (KRW) (about 94 USD); [†]At the lower cost: 40,000 KRW; [‡]Like the coming weekend or the coming vacation; [§]*P* = 0.0695. HepA vaccination, hepatitis A vaccination; OR, odds ratio; CI, confidence interval.

the current expensive cost as barrier was significantly associated with not having willingness toward prompt HepA vaccination.

DISCUSSION

HepA vaccination is one of the strong candidates for NIP for children in Korea (12-14), but even if it is introduced into NIP, adolescents aged older than 12 yr would not benefit. However, higher vaccination coverage among adolescents and young adults is needed for a rapid decrease in the incidence of hepatitis A in Korea. Understanding of the attitudes to and the health-belief on HepA vaccination and hepatitis A among parents can help develop strategies for HepA vaccination for children and adolescents. In this study, we showed that only 68% of mothers with children aged 7-18 yr were willing to vaccinate their children against HAV at current cost. Mothers' willingness toward HepA vaccination was not higher than 82% at current cost in all situations. Moreover, the proportion of the mothers who would vaccinate the child against HAV promptly was only 32%. A study of hepatitis A in Korea reported that the incidence rate less than 50 per 100 thousands would be achieved at year 2029 with current vaccination coverage of 50% among children aged 1 yr and the most cost-effective vaccination strategy was that of 90% vaccination among children aged 1 yr and 50% to adults aged 19-39 yr (11). However, a prioritized intervention to increase HepA vaccination coverage among young adults or adolescents over children might not be easily accepted by the public. Moreover all vaccination strategies in the study were cost-effective in a societal perspective (not in a governmental perspective) when the loss of productivity due to hepatitis A was considered. Since the adolescents aged more than 12 yr were not covered by the

Korean NIP, the HepA vaccination coverage among adolescents is projected to be substantially low as shown by low willingness in this study, similar to many other adolescent vaccines (15, 16). Therefore, once the HepA vaccination policy and the strategy for the children aged 1 yr is launched, a more aggressive approach and optimized strategy targeted towards the adolescents must be implemented as the next step to increase the vaccination coverage rate and to lower the incidence of hepatitis A.

Our analysis showed that mothers' willingness to HepA vaccination for their children was associated with family's income, family member's travel overseas and plan to send the child overseas. All these variables were closely related to the socioeconomic status of the family. Socioeconomic status of the family is known to be an important factor for the vaccination of the child (6, 8, 17, 18). Hepatitis A vaccination coverage among adolescents was significantly associated with poverty status in areas where there was only recommendation and no Vaccines for Children (VFC) program (6, 8). In areas with VFC, there was no association between poverty status and HepA vaccination coverage because VFC could provide HepA vaccination to under-insured children. In this study, the willingness to HepA vaccination at current cost was 10%-15% lower among mothers of family monthly income < 3 million KRW and those without response to income than that among mothers of family monthly income ≥ 3 million KRW. The median household income in 2011 was 33 million KRW (19) so we speculate that HepA vaccination will continue to be not easily accessible for a considerable number of families at current cost. Assuming the cost reduction to the half the current level increased the willingness from 68% to 92% and slightly reduced the difference in willingness between income groups, but family income was still asso-

ciated with the willingness toward HepA vaccination even at the reduced cost.

Number of children was associated with the willingness to HepA vaccination at current cost but not at half the cost. Number of children in family, family size, or birth order was reported to be related to vaccination completeness in studies of some countries (20-22). Although there are several economic supportive systems such as benefit for housing, tax deduction, and reduction of the electricity bill for household with multiple children in Korea, medical expenses for vaccination not included in NIP must be paid out of pocket only by each household and it may be heavier burden to the parents with multiple children. At half the cost, the difference in mothers' willingness according to the number of children was decreased and statistically not significant.

The largest difference of 23 percentage points in the willingness was demonstrated between mothers with and without plan to send the child overseas. Although the proportions of the household with monthly income of 3 million KRW or more in these two groups were very different (83% and 61%), the plan to send the child overseas was independently associated with the willingness toward HepA vaccination at current cost and at half the cost even after adjustment for the household income. To our knowledge, this is the first study to report that the willingness to any vaccination was associated with plan to send the child overseas. It may be attributed to the epidemic characteristics of hepatitis A and the specific context of the country. However, the plan was not associated with the willingness for prompt vaccination and this suggested that the plan or intention for the future is not sufficient to urge or encourage the patient to vaccinate the child promptly and increase the vaccination coverage rate rapidly.

One of the novel findings in the study was that neither socio-demographic factor nor family characteristic was associated with the willingness towards prompt HepA vaccination at current cost and only the mother's health-belief on hepatitis A and HepA vaccination was significantly associated. Mother's health-belief was a more influential factor affecting mothers' willingness than any other sociodemographic characteristic. Especially, the mother's perception of the susceptibility of the child to get hepatitis A and concern about the vaccine cost were associated with the willingness to HepA vaccination at current cost, at half cost and prompt vaccination. This has important implications in optimizing communication between healthcare providers and parents (23). If the healthcare provider, even at current cost of HAV vaccine, address the parent focusing on the susceptibility of their child to hepatitis A (especially to the high-risk children), it could help the parents perceive the risk and change their willingness toward HepA vaccination.

In addition, it is important that all subgroups stratified by family characteristics showed the willingness for prompt vacci-

nation to be less than 45%. This implicates that parents would not be willing to vaccinate the child against HAV without a proactive intervention or incentive such as lowering the out-of-pocket costs. Perceived barrier, i.e., concerns about the cost of a HAV vaccine could be removed not only by communication with healthcare providers but also by a substantial decrease in cost. Therefore, if we want to increase the vaccination rate among adolescents, some other special strategies are necessary in addition to those for parents' health-belief.

This study had several limitations. First of all, the response rate was only 23.5% that the generalizability could be somewhat limited. However, it is not a very low response rate for telephone surveys in Korea and increased response rates are not always associated with higher accuracy of the surveys (24, 25). Moreover, it is certain that in spite of the low response rates of the telephone surveys in Korea, it was the most feasible and efficient method for national sample in the situation where there were no national statistics for mothers of the children. Next, some differences in distribution of mother's demographic characteristics could exist between our study sampling frame and the target population. The target of our study was the mothers with children aged 7-18 yr any of whose children had not gotten HepA vaccination. However, the sampling frame accurately reflecting their age and area distribution could not be made because there are no national statistics for mothers of the children at a certain age group and some mothers with more than one child, and we could not know how many mothers to be excluded due to children's history of HepA vaccination. Therefore the representativeness of our sample for the target population of the mothers cannot be easily evaluated but it would be the most optimal and the least biased to sample with proportional quota to the number of children under the assumption that the vaccination rates are similar across the children of different ages and geographic areas.

Nonetheless, this study is the first national survey to assess the public attitude towards HepA vaccination for children and adolescents, who are not in the beneficiary age for NIP. Also, we asked the willingness toward HepA vaccination not only at current cost but also at several different scenarios related to hepatitis A. Therefore we can approximately guess the parents' response and preference toward the HepA vaccination at half the cost, at no cost, in an epidemic or in preparation for living or travelling abroad. We included the questions about the mothers' health-belief on hepatitis A and vaccine, thereby got a cue on optimal approach in communicating to the public about HepA vaccination.

In conclusion, we found the mothers' willingness to HepA vaccination for the children aged 7-18 yr in Korea was 68% at current cost and increased to 92% at half cost. Family income, the number of children, plan to send the child abroad, and the mother's health-belief on hepatitis A and HepA vaccination are

significantly associated with it. Targeted interventions and an optimized strategy are needed for an increase in HAV vaccination rate among children and adolescents.

DISCLOSURE

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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