

BMJ Open Public subsidies and the recommendation of child vaccines among primary care physicians: a nationwide cross-sectional study in Japan

Yuta Sakanishi,^{1,2} Yosuke Yamamoto,² Megumi Hara,³ Norio Fukumori,¹ Yoshihito Goto,² Tesshu Kusaba,⁴ Keitaro Tanaka,³ Takashi Sugioka,¹ Japan Primary Care Association Vaccine Project Team,⁵ Shunichi Fukuhara^{2,6}

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¹Faculty of Medicine, Community Medical Support Institute, Saga University, Saga, Japan

²Department of Healthcare Epidemiology, School of Public Health in the Graduate School of Medicine, Kyoto University, Kyoto, Japan

³Department of Preventive Medicine, Faculty of Medicine, Saga University, Saga, Japan

⁴The Hokkaido Centre for Family Medicine, Sapporo, Japan

⁵Japan Primary Care Association, Tokyo, Japan

⁶Center for Innovative Research for Communities and Clinical Excellence, Fukushima Medical University, Fukushima, Japan

Correspondence to

Dr Yosuke Yamamoto;
yamamoto.yosuke.5n@kyoto-u.ac.jp

ABSTRACT

Objective Although public subsidies and physician recommendations for vaccination play key roles in increasing childhood vaccination coverage, the association between them remains uncertain. This study aimed to identify the association between awareness of public subsidies and recommendations for *Haemophilus influenzae* type b (Hib), *Streptococcus pneumoniae* (pneumococcal conjugate vaccine (PCV)) and human papillomavirus (HPV) vaccinations among primary care physicians in Japan.

Design This is a cross-sectional study.

Setting In 2012, a questionnaire was distributed among 3000 randomly selected physicians who were members of the Japan Primary Care Association.

Participants From the questionnaire, participants were limited to physicians who administered childhood vaccinations.

Primary and secondary outcome measures The primary measures were participants' awareness of public subsidies and their recommendation levels for Hib, PCV and HPV vaccines. Multiple logistic regression analysis was performed to investigate the association between awareness and recommendation, with adjustment for possible confounders.

Results The response rate was 25.8% (743/2880). Of 743 physician respondents, 434 were included as analysis subjects. The proportions of those who recommended vaccinations were 57.1% for Hib, 54.1% for PCV and 58.1% for HPV. For each vaccine, multivariable analyses showed physicians who were aware of the subsidy were more likely to recommend vaccination than those who were not aware: the adjusted ORs were 4.21 (95% CI 2.47 to 7.15) for Hib, 4.96 (95% CI 2.89 to 8.53) for PCV and 4.17 (95% CI 2.00 to 8.70) for HPV.

Conclusions Primary care physicians' awareness of public subsidies was found to be associated with their recommendations for the Hib, PCV and HPV vaccines. Provision of information about public subsidies to these physicians may increase their likelihood to recommend vaccination.

Strengths and limitations of this study

- ▶ This is the first study to focus on the association between awareness of primary care physicians (PCPs) concerning vaccination subsidies and those PCPs' recommendations for vaccinations for children.
- ▶ To explore the characteristics of PCPs found associated with less vaccination recommendation, multi-variable logistic regression analysis was performed with background factors such as the physician's postgraduate year, proportion of paediatric patients and experience raising children as a parent.
- ▶ Although participants were randomly selected, one limitation was non-responder bias, which was due to the PCPs' voluntary participation in the survey.
- ▶ Another limitation was that the generalisability of the results to PCPs outside of Japan was unclear.

INTRODUCTION

Vaccination has proven to be a successful and cost-effective health intervention in preventive care.¹ Vaccination against *Haemophilus influenzae* type b (Hib) is a successful example. In the USA, the introduction of the Hib vaccine reduced the incidence of invasive Hib disease by 99%,² while in Kenya a 93% decline was seen following vaccination.³ Therefore, many childhood vaccines (including Hib) are routinely provided, especially in higher income countries, where coverage is relatively high.^{4–8}

In Japan, however, many important vaccines, including Hib, *Streptococcus pneumoniae* (seven-valent pneumococcal conjugate vaccine (PCV)) and human papillomavirus (HPV), were voluntary rather than routine, and voluntary vaccinations were not covered by the National Immunisation Programme, without subsidies by the Government of

Japan.⁹ These vaccines were introduced in Japan in the following years: Hib in 2008, PCV in 2010 and bivalent HPV in 2009. There were no public subsidies for them at the time they were initially offered. Without public subsidies, patients must pay an out-of-pocket fee, and this cost burden may serve as a barrier to receiving vaccination.⁹ Routine vaccinations are defined by the Preventive Vaccination Law and scheduled in the National Immunisation Programme. These vaccinations are not mandatory, although the Government of Japan strongly recommends them. In principle, vaccinations are administered individually, mainly funded by the national and local governments, and free of charge to recipients in private or public facilities at the request of the local government.^{9 10} Coverage of traditional, routine vaccinations (eg, those for diphtheria, tetanus and measles) is high, and their associated diseases are well controlled.^{9 11 12} However, coverage of voluntary vaccinations is much lower, and some diseases those vaccinations target are endemic in the population.^{9 12} The Hib vaccine, for example, was first introduced to Japan in 2008 on a voluntary basis and had estimated coverage of 5%–10% in 2010.¹³ Therefore, the Government of Japan implemented subsidies for local governments for Hib, PCV and HPV vaccine fees from November 2010, all at the same time.¹⁴ The subsidies were intended for all children aged over 2 months and under 5 years for Hib and PCV, and all girls aged 12–16 years for HPV.¹⁵ Local governments determined the subsidy amounts. All local governments have now started providing public subsidies for these three vaccines.

It is generally accepted that recommendation of vaccination, to children and their parents by a physician, is important for increasing coverage.^{14 16–19} Primary care physicians (PCPs) provide care for all ages, from children to older people, and play a key role in childhood vaccination as vaccine providers as well as paediatricians. However, no previous studies have examined PCPs' level of awareness of public subsidies for childhood vaccines in Japan, and the association between this awareness and recommendations for vaccination. Therefore, this study aimed to examine this association among PCPs in Japan for the Hib, PCV and HPV vaccinations.

METHODS

Study design, setting and population

This study used a cross-sectional design with data drawn from a questionnaire conducted by the Japan Primary Care Association (JPCA), the largest academic association for PCPs in Japan. The majority of the JPCA physician members were internists working as PCPs at a clinic or hospital. The survey was conducted in September–November 2012. In total, 3000 physicians were randomly selected from among the 5977 JPCA physician members. Selection was made using a random number list. Subject participants were then selected from among these 3000 physicians in accordance with the inclusion and exclusion criteria. The inclusion criteria were physicians who

were JPCA members and who administered childhood vaccination (defined as those who administered at least one of the Hib, PCV and HPV vaccines in daily medical practice). The exclusion criteria were physicians who were retired or living out of Japan or within 2 years of their postgraduate year, as the latter group are classified as 'junior residents' in Japan. Questionnaire items were based on previous studies.^{16 17 19–28} We used a self-administered, anonymous questionnaire design and collected data on the participating PCPs' main practice category, practice setting (clinic, hospital or other), local government of the practice, population under jurisdiction of the local government, and experience as a kindergarten or other school physician. Questionnaires were sent to each participant by postal mail. Additional details are given below.

Patient and public involvement

Patients and other members of the public were not involved in this study.

Main exposure

The main exposure of this study was physicians' awareness of the existence of local government public subsidies for the target vaccine (awareness of public subsidy). For each vaccine, respondents were asked 'Does the local government of your place of practice subsidize the vaccination?' The response options were 'Yes', 'No' and 'I don't know'. Answers of 'Yes' were defined as 'awareness of public subsidy'. Answers of 'No' or 'I don't know' were defined as 'no awareness of public subsidy'.

Main outcome

The main outcome of this study was PCPs' active recommendation of a target vaccine to children and the children's parents in daily medical practice ('recommendation'). For each vaccine, the respondents were asked 'How do you recommend a target vaccine to vaccinees and their parents?' The response options, on a Likert-type scale, were 'Always recommend', 'Maybe recommend', 'No opinion', 'Not recommend actively' and 'Not recommend'. Answers of 'Always recommend' were defined as 'recommendation'. 'Maybe recommend', 'No opinion', 'Not recommend actively' and 'Not recommend' were defined as 'no recommendation'.

Possible confounders

Possible confounders were the physician's sex, postgraduate year, a proportion of paediatric patients (paediatric patients in the total patient population) that was high ($\geq 10\%$) or low ($< 10\%$), and experience raising children as a parent. We added in these data from the questionnaire and also used public information held by the local government to investigate the type of the subsidy (full subsidy or not) for the three vaccines for each participant.

Statistical analyses

Logistic regression analysis was performed for each target vaccine (Hib, PCV and HPV) to investigate the association

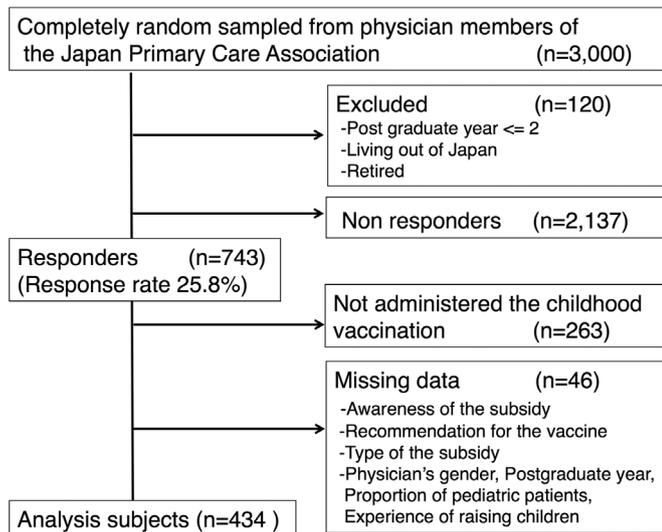


Figure 1 Study flow.

between PCPs' awareness of a public subsidy for the target vaccine and their recommendation of that vaccine. Then, multiple logistic regression analysis was performed to investigate the association between awareness and recommendation, adjusting for possible confounders (full subsidy or not, physician's sex, postgraduate year, proportion of paediatric patients and experience raising children).

The analysis subjects were set after excluding participants with missing data for the main exposure, main outcome and possible confounders (mentioned above).

All statistical analyses used two-tailed tests of significance, with significance set at 0.05. Analyses were performed with Stata/SE V.13.1. Sensitivity analysis was performed for each vaccine using another method of recategorisation to reflect the dichotomisation of the dependent

variable (recommendation), with the response option 'Maybe recommend' included in 'recommendation'.

We obtained written informed consent from all participants before we conducted the survey.

RESULTS

Study flow and demographics

Of the 3000 randomly selected PCPs, 120 were excluded based on the inclusion and exclusion criteria, leaving a sample of 2880. We received responses from 743 PCPs, for a response rate of 25.8%. The respondents were from all 47 prefectures of Japan. Of these respondents, 480 (64.6%) administered childhood vaccinations. We analysed data for 434 (58.4%) after excluding 46 (6.2%) with missing data for covariates (figure 1). The majority of these PCPs were men, of postgraduate years 11–40, reported a clinical category of primary care, reported their practice setting as clinic and had experience raising children (table 1).

Hib vaccine

The characteristics of PCPs were stratified by recommendation of the Hib vaccine and the association between awareness of an Hib vaccine public subsidy and vaccination recommendation (table 2). We found 327 (75.3%) PCPs reported awareness of a public subsidy and 248 (57.1%) recommended the vaccine. PCPs who reported awareness were significantly more likely to recommend the vaccine than those who were not aware (non-adjusted analysis: OR 6.18, 95% CI 3.77 to 10.12, $p < 0.001$; multivariable analysis: adjusted OR (AOR) 4.21, 95% CI 2.47 to 7.15, $p < 0.001$). A higher proportion of paediatric patients and of PCPs with experience raising children were positively associated with recommendation.

Table 1 Participants' characteristics

Characteristics	Analysis subjects, n=434	Responders, n=743	All physician members*, n=5977
	n (%)	n (%)	n (%)
Gender: male	367 (84.6)	624 (84.0)	5071 (84.8)
Postgraduate year			
3–10	90 (20.7)	153 (20.6)	664 (11.1)
11–40	318 (73.3)	527 (71.0)	4248 (71.1)
≥41	26 (6.0)	62 (8.4)	769 (12.9)
Main practice category: primary care	358 (82.5)	556 (74.8)	–
Practice setting: clinic	307 (70.7)	388 (52.3)	–
Paediatric patients ≥10%	174 (40.1)	186 (26.2)	–
Population of local government ≥50 000	277 (64.0)	527 (71.5)	–
Experience of kindergarten or other school physician	284 (65.4)	403 (54.2)	–
Experience raising children	343 (79.0)	568 (76.5)	–

Main practice category: primary care: answered main practice category as family physician or general practitioner or hospitalist/general physician; paediatric patients: proportion of paediatric patients in the total patient population.

*Physician members of the Japan Primary Care Association as of September 2012.

Table 2 Primary care physicians' awareness of public subsidies and recommendation levels for Hib vaccine, seven-valent PCV and HPV vaccine

Awareness of public subsidy for each vaccine	Total, n (%)	Recommendation level for each vaccine, n (%)				Not recommend
		Always recommend	May be recommend	No opinion	Not recommend actively	
Hib vaccine						
Awareness (+)	327 (75.3)	221 (67.6)	78 (23.9)	23 (7.0)	3 (0.9)	2 (0.6)
Awareness (-)	107 (24.7)	27 (25.2)	40 (37.4)	27 (25.2)	8 (7.5)	5 (4.7)
Total	434 (100)	248 (57.1)	118 (27.2)	50 (11.5)	11 (2.5)	7 (1.6)
PCV						
Awareness (+)	315 (72.6)	211 (67.0)	77 (24.4)	22 (7.0)	4 (1.3)	1 (0.3)
Awareness (-)	119 (27.4)	24 (20.2)	45 (37.8)	36 (30.3)	8 (6.7)	6 (5.0)
Total	434 (100)	235 (54.1)	122 (28.1)	58 (13.4)	12 (2.8)	7 (1.6)
HPV vaccine						
Awareness (+)	389 (89.6)	241 (62.0)	121 (31.1)	19 (4.9)	6 (1.5)	2 (0.5)
Awareness (-)	45 (10.4)	11 (24.4)	18 (40.0)	13 (28.9)	3 (6.7)	0 (0)
Total	434 (100)	252 (58.1)	139 (32.0)	32 (7.4)	9 (2.1)	2 (0.5)

Hib, *Haemophilus influenzae* type b; HPV, human papillomavirus; PCV, pneumococcal conjugate vaccine.

However, a higher postgraduate year was inversely associated (table 3).

Pneumococcal conjugate vaccine

The characteristics of PCPs were stratified by recommendation of the PCV and association between awareness of a PCV public subsidy and vaccination recommendation (table 2). Overall, 315 (72.6%) PCPs reported awareness of a public subsidy and 235 (54.1%) recommended the vaccine. Physicians who reported awareness were significantly more likely to recommend vaccination than those who were not aware (non-adjusted analysis: OR

8.03, 95% CI 4.84 to 13.32, $p < 0.001$; multivariable analysis: AOR 4.96, 95% CI 2.89 to 8.53, $p < 0.001$). A higher proportion of paediatric patients and of PCPs with experience raising children were positively associated with vaccination recommendation, and higher postgraduate year was inversely associated (table 4).

HPV vaccine

The characteristics of PCPs stratified by recommendation of the HPV vaccine and the association between the awareness of an HPV vaccine public subsidy and vaccination recommendation are presented (table 2). We found

Table 3 Association between primary care physicians' characteristics and recommendation of Hib vaccine

Variable	Recommendation for Hib vaccine, n (%)			Non-adjusted analysis			Multivariable analysis		
	Total, n=434	Recommendation (+), n=248	Recommendation (-), n=186	OR	95% CI	P values	AOR	95% CI	P values
Awareness of public subsidy for Hib vaccine	327 (75.4)	221 (89.1)	106 (57.0)	6.18	3.77 to 10.12	<0.001	4.21	2.47 to 7.15	<0.001
Full subsidy	371 (85.5)	209 (84.3)	162 (87.1)	-	-	-	0.76	0.41 to 1.41	0.39
Male	367 (84.6)	205 (82.7)	162 (87.1)	-	-	-	0.97	0.52 to 1.80	0.93
Postgraduate year									
3-10	90 (20.7)	68 (27.4)	22 (11.8)	-	-	-	Ref		
11-40	318 (73.3)	168 (67.7)	150 (80.6)	-	-	-	0.32	0.17 to 0.61	<0.001
≥41	26 (6.0)	12 (4.8)	14 (7.5)	-	-	-	0.19	0.07 to 0.53	0.001
Paediatric patients ≥10%	174 (40.1)	127 (51.2)	47 (25.3)	-	-	-	2.16	1.37 to 3.41	0.001
Experience raising children	343 (79.0)	205 (82.7)	138 (74.2)	-	-	-	1.96	1.10 to 3.47	0.021

Multivariable analysis: multiple logistic regression analysis adjusted with above variables; non-adjusted analysis: logistic regression analysis; paediatric patients: proportion of paediatric patients in the total patient population. AOR, adjusted OR; Hib, *Haemophilus influenzae* type b; Ref, reference.

Table 4 Association between primary care physicians' characteristics and recommendation of seven-valent PCV

Variable	Recommendation for PCV, n (%)			Non-adjusted analysis			Multivariable analysis		
	Total, n=434	Recommendation (+), n=235	Recommendation (-), n=199	OR	95% CI	P values	AOR	95% CI	P values
Awareness of public subsidy for PCV	315 (72.6)	211 (89.8)	104 (52.3)	8.03	4.84 to 13.32	<0.001	4.96	2.89 to 8.53	<0.001
Full subsidy	369 (85.0)	194 (82.6)	175 (87.9)	–	–	–	0.62	0.33 to 1.17	0.14
Male	367 (84.6)	194 (82.6)	173 (86.9)	–	–	–	0.98	0.52 to 1.83	0.94
Postgraduate year									
3–10	90 (20.7)	66 (28.1)	24 (12.1)	–	–	–	Ref		
11–40	318 (73.3)	158 (67.2)	160 (80.4)	–	–	–	0.29	0.15 to 0.56	<0.001
≥41	26 (6.0)	11 (4.7)	15 (7.5)	–	–	–	0.18	0.06 to 0.54	0.002
Paediatric patients ≥10%	174 (40.1)	127 (54.0)	47 (23.6)	–	–	–	2.5	1.57 to 3.98	<0.001
Experience raising children	343 (79.0)	197 (83.8)	146 (73.4)	–	–	–	2.61	1.43 to 4.74	0.002

Multivariable analysis: multiple logistic regression analysis adjusted with above variables; non-adjusted analysis: logistic regression analysis; paediatric patients: proportion of paediatric patients in the total patient population. AOR, adjusted OR; PCV, pneumococcal conjugate vaccine; Ref, reference.

that 389 (89.6%) PCPs reported awareness of the public subsidy and 252 (58.1%) recommended the vaccine. Physicians who reported awareness were significantly more likely to recommend vaccination than those who were not aware (non-adjusted analysis: OR 5.03, 95% CI 2.47 to 10.24, $p < 0.001$; multivariable analysis: AOR 4.17, 95% CI 2.00 to 8.70, $p < 0.001$). Experience raising children was positively associated with recommendation, and higher postgraduate year was inversely associated (table 5).

Sensitivity analysis

The sensitivity analysis included recategorised outcomes for recommendation of vaccines. The results

demonstrated that for each vaccine, PCPs who reported awareness of a subsidy were significantly more likely to recommend vaccination than those who were not aware: AOR 3.52 (95% CI 1.91 to 6.49, $p < 0.001$) for the Hib vaccine, 4.42 (95% CI 2.45 to 7.98, $p < 0.001$) for the PCV, and 5.08 (95% CI 2.29 to 11.25, $p < 0.001$) for the HPV vaccine.

DISCUSSION

This is the first investigation focused on the proportion of PCPs who have awareness of vaccination subsidies and their recommendations of Hib, PCV and HPV vaccines,

Table 5 Association between primary care physicians' characteristics and recommendation of HPV vaccine

Variable	Recommendation for HPV vaccine, n (%)			Non-adjusted analysis			Multivariable analysis		
	Total, n=434	Recommendation (+), n=252	Recommendation (-), n=182	OR	95% CI	P values	AOR	95% CI	P values
Awareness of public subsidy for HPV vaccine	389 (89.6)	241 (95.6)	148 (81.3)	5.03	2.47 to 10.24	<0.001	4.17	2.00 to 8.70	<0.001
Full subsidy	385 (88.7)	225 (89.3)	160 (87.9)	–	–	–	1.25	0.66 to 2.35	0.49
Male	367 (84.6)	210 (83.3)	157 (86.3)	–	–	–	0.96	0.54 to 1.72	0.9
Postgraduate year									
3–10	90 (20.7)	61 (24.2)	29 (15.9)	–	–	–	Ref		
11–40	318 (73.3)	174 (69.1)	144 (79.1)	–	–	–	0.47	0.27 to 0.82	0.008
≥41	26 (6.0)	17 (6.8)	9 (5.0)	–	–	–	0.72	0.27 to 1.97	0.53
Paediatric patients ≥10%	174 (40.1)	112 (44.4)	62 (34.1)	–	–	–	1.34	0.88 to 2.03	0.17
Experience raising children	343 (79.0)	211 (83.7)	132 (72.5)	–	–	–	2.21	1.31 to 3.72	0.003

Multivariable analysis: multiple logistic regression analysis adjusted with above variables; non-adjusted analysis: logistic regression analysis; paediatric patients: proportion of paediatric patients in the total patient population. AOR, adjusted OR; HPV, human papillomavirus; Ref, reference.

and the association between awareness of such subsidies and recommendation of vaccination. We found a positive association between physicians' awareness of the subsidy and their recommendation of vaccination.

These vaccines were recently introduced in Japan: Hib in 2008, PCV in 2010, bivalent HPV vaccine in 2009 and quadrivalent HPV vaccine in 2011. The subsidies for these three vaccines were implemented from November 2010. When subsidies were offered, information about them was conveyed to patients/families and providers through public outlets such as local government websites or public relations magazines. Additionally, public health nurses informed parents at the time the children received health check-ups. Local governments also sent notices about the subsidies to each medical facility and medical association. Gathering of data for this study was conducted in 2012, meaning the results reflect the actual clinical situation after the new introduction of vaccines among PCPs in Japan. The estimated coverage rates for these vaccines in 2012 were 70%–90% for Hib,^{29 30} 80%–90% for PCV^{29 31} and 65%–75% for HPV.^{32 33} Our study showed that even among PCPs who administered childhood vaccinations, not all were aware that subsidies existed and not all actively recommended vaccination. Vaccination fees serve as a barrier to vaccination for patients,⁹ and PCPs need access to information about vaccine costs, especially with regard to public subsidies. Of the three vaccines studied, the HPV vaccine was most commonly recognised by the surveyed PCPs. This was also the most expensive of these vaccines, and healthcare professionals have cited financial concerns as a barrier to vaccination.³⁴ It therefore appears PCPs need to be more aware of available subsidies for this vaccination.

However, the proportions of PCPs' recommendations were similar for all three vaccines. These proportions were low when compared with those in other countries; for instance, 68% of family physicians in the USA adopted recommendations for PCV vaccination in 2001, 1 year after the Centers for Disease Control and Prevention recommended it.²⁴ In 2008, 50% of the family physicians who administered the HPV vaccine in the USA strongly recommended the vaccine for girls aged 11–12 years and 85% for girls aged 13–15 years.²⁵ However, studies conducted in 2011 reported that 40.0% of physicians (family physicians, paediatricians and obstetricians/gynaecologists) in the USA always recommended HPV vaccination, as did 45.6% of general practitioners in France.^{35 36} Although the proportion of PCP recommendations of vaccination may differ by country and time of year, recommendations from healthcare providers are important for patients, especially with regard to new vaccine.³⁷

For all three vaccines studied, there was a statistically significant association between PCPs' awareness of a public subsidy and their recommendation of vaccination. In comparing PCPs who had no awareness of subsidies with those who were aware, the AOR for recommendation was 4.21 for the Hib vaccine, 4.96 for the PCV and 4.17 for the HPV vaccine (tables 3–5). These results

suggest awareness is an important factor behind vaccination recommendation. The robustness of our results was demonstrated in sensitivity analysis using another method of recategorisation. Recent studies have highlighted that the cost of vaccination is also a barrier for physicians to recommend vaccination.^{38 39} Multiple logistic regression analysis showed that, in addition to awareness, a higher proportion of paediatric patients were positively associated with recommendation of Hib and PCV vaccination, and experience raising children was positively associated with recommendation of all three vaccines (tables 3–5). These results suggest provision of information or experience with children on a regular basis may affect PCPs' recommendations. We also found that a higher postgraduate year was inversely associated with recommendation (tables 3–5). The Hib, PCV and HPV vaccines were recently introduced in Japan, and PCPs with a lower postgraduate year may have greater interest in or knowledge about these vaccines because of their more recent education or training. This suggests providing information about public subsidies to older PCPs may be more effective than providing information to younger PCPs. A study conducted after the introduction of the Hib vaccine in the USA reported younger physicians were more accepting of the vaccine than older ones; this supports our results.⁴⁰

Our study also suggested PCPs' awareness of public subsidies, their having more paediatric patients and their having experience raising children were important factors in increasing their recommendations of childhood vaccination. For voluntary vaccinations without public subsidies, governmental introduction of a public subsidy may play an important role in increasing coverage.^{9 39 41} For vaccinations already subsidised, implementing a plan to inform PCPs about the subsidy and providing PCPs with updated education and information about the vaccine and subsidy system (considering physician characteristics, especially age and those with fewer paediatric patients) may increase the proportion of those who recommend vaccination.

This study did have some limitations. First, there was a potential non-responder bias due to the low response rate. The proportion of younger PCPs (postgraduate years 3–10) was higher among responders in this study than in the target population (table 1); therefore, PCPs who more actively promoted vaccination may have been more likely to respond. The actual levels of PCPs' awareness and recommendations may be lower. Second, factors such as knowledge of vaccination, including vaccine safety and effectiveness, PCPs' circumstances or abilities, and PCPs' experience may have affected their recommendation behaviour.³⁶ We did not investigate PCPs' knowledge of vaccine safety and effectiveness; therefore, the association between their knowledge of vaccines and their vaccination recommendation behaviour should be investigated in a future study.³⁹ To account for this limitation, we limited our analysis to PCPs who administered childhood vaccinations and we adjusted for the proportion of paediatric patients (factors related to PCPs' medical care

circumstances and abilities). As is a general limitation of observational studies, we did not evaluate the effect of unknown confounding factors. Finally, although the study participants were physician members of the JPCA, the largest society for PCPs in Japan, generalisability of the results to PCPs outside of Japan was unclear. Vaccination policy in Japan also changed after this study was conducted^{9,10}; therefore, an interannual survey is needed to accurately comprehend the current situation of vaccination among PCPs.

CONCLUSIONS

In this study, we described the proportion of PCPs' awareness of existence of public subsidies and their recommendations for the Hib, PCV and HPV vaccines, and revealed a significant association between awareness and recommendation. Even among PCPs who administered childhood vaccinations, there was variability in these two areas. Our results suggest that informing PCPs about public subsidies may increase their recommendations for these vaccines and improve vaccination coverage.

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Contributors All authors declare they have contributed to this article. YS conducted the questionnaire, designed and implemented the survey, and performed the analysis and interpretation of the data. YY performed the analysis and interpretation of the data and critical revisions. MH conducted the questionnaire, designed the study and performed critical revisions. NF conducted the questionnaire and performed the interpretation of the data and critical revisions. YG performed the interpretation of the data and critical revisions. TK arranged for the sampling and critical revisions. KT performed the interpretation of the data and critical revisions. TS conducted the questionnaire and performed the interpretation of the data and critical revisions. The JPCAVPT implemented the survey and performed critical revisions. SF performed the interpretation of the data and critical revisions. All authors read and approved this manuscript version for submission.

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Competing interests None declared.

Patient consent Not required.

Ethics approval This study protocol was approved by the Institutional Review Board of Saga University Hospital (2012-05-13) and the Kyoto University Graduate School and Faculty of Medicine Ethics Committee (E2528).

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Data sharing statement No additional data are available.

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