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Perinatal immunization education improves immunization rates and knowledge: A randomized controlled trial^{☆,☆☆}

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Abstract

Objectives: To determine if providing perinatal immunization education positively changes the immunization status of infants, influences the infant immunization knowledge, attitudes and beliefs of mothers and affects the intent to vaccinate children in Japan where immunization education is limited.

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Conflict of interest statement

All authors have no conflict of interest.

Appendix B. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.ypmed.2013.03.003>.

Methods: Pregnant women were recruited from three sites in Tokyo, Japan and were assigned to two intervention (pre- or postnatal education) groups and a control group. The immunization status of infants was assessed and a written survey was performed before and after the intervention.

Results: Among 119 study participants, 106 subjects replied to the post-survey. The intervention groups (34.3%) had higher immunization rates in infants at three months of age than the control group (8.3%) ($P = 0.005$); however, no differences were observed between the prenatal (29.4%) and postnatal groups (38.9%) ($P = 0.40$). The percentage of women intended to vaccinate their infants was higher in the intervention groups (61.4%) compared to the control group (33.3%) ($P = 0.01$). The improvement in score for basic knowledge was higher in the intervention groups, particularly in the prenatal group (mean $\pm$ S.D.: 3.4 ± 1.8) compared to the control (1.9 ± 1.9) ($P = 0.003$).

Conclusions: Perinatal immunization education improved the immunization status of infants, increased the women's knowledge on immunization and intention to vaccinate their infants.

Keywords

Education; Infantile immunization; Parents; Perinatal; Vaccination rate

Introduction

The “vaccine gap” is a term that has been used to emphasize the delayed national immunization program in Japan (Saitoh and Okabe, 2012). In Japan, some vaccines are under the national immunization law and other vaccines are considered voluntary vaccines. The determination for which vaccines are categorized as covered under the law or voluntary vaccines has been determined by the government. The decision about which voluntary vaccines are received depends on the parents and they are required to pay an out-of-pocket fee. This financial burden is the major hurdle to increasing the vaccination coverage rates of the voluntary vaccines in Japan. For example, the penetration rate of seven-valent pneumococcal conjugate vaccine (PCV7) was <10% before the introduction of national temporary budget and the rate of hepatitis B virus (HBV) vaccine is <1%. The national temporary budget started in 2011 to help provide PCV7, *Haemophilus influenzae* type b (Hib), and human papilloma virus (HPV) vaccines without out-of-pocket fee and has contributed to increase vaccination rates of three vaccines; however, this budget still being categorized as temporary and the government has not revealed a specific future plan.

The other important issue is that immunization education programs regarding the voluntary vaccines for parents have not been sufficiently implemented compared to the programs explaining the vaccines under the law. Information on the vaccines has been available to educate caregivers, including maternal booklets created by local governments. However, this information has been sparse and not standardized or widely distributed for the voluntary vaccines. As a result, most parents consider voluntary vaccines to be less important than the vaccines under the law (Murashige et al., 2011). These current situations have led to a failure to control diseases prevented by voluntary vaccines, such as HBV, varicella zoster virus, mumps, Hib, *Streptococcus pneumoniae*, and rotavirus. Providing more information about

the importance of these vaccines may overcome the cost barriers and lead to increases in the vaccination rates.

It is important to know when education programs should be implemented and what information should be provided to parents (Fielding et al., 1994; Waterman et al., 1996). In the United States (U.S.), infant immunization education is systematically and routinely provided (Davis et al., 2004); however, the lack of time dedicated to education has been considered the greatest barrier to communication about the risks and benefits of vaccines (Davis et al., 2002, 2004). Mothers have indicated that they do not have sufficient information regarding immunization (Gust et al., 2005, 2008; Kennedy and Gust, 2005). The effectiveness of perinatal educational intervention has recently been demonstrated to improve maternal knowledge, attitudes, and beliefs regarding vaccination in the U.S. (El-Mnohandes et al., 2003; Vannice et al., 2011; Zuniga de Nuncio et al., 2003). These studies demonstrated that early intervention programs have been considered as useful educational information. In contrast, there are no data available that demonstrate the effectiveness of perinatal educational intervention programs on the vaccination rate in infants and improving the general vaccination knowledge base in Japan.

The purpose of this study was (i) to verify the effect of early educational intervention in a perinatal setting and (ii) to investigate the most effective perinatal period of time for initial immunization education in Japan, where the vaccination system has been behind compared to those in other developed countries.

Methods

Study setting

This randomized controlled trial study investigated the effectiveness of an infant immunization education program for pregnant and postpartum women during the perinatal period. Study subjects were recruited at three obstetrics hospitals in a metropolitan region in Tokyo from June 1, 2011 to July 31, 2011. The hospitals included a national hospital in Tokyo, a private hospital in Tokyo, and a maternity home in Kanagawa. The annual number of deliveries at each hospital was approximately 2000, 1000, and 250, respectively.

Eligibility and enrollment

Pregnant women ages 18 years or older were recruited by the investigators during gestational weeks 32–33 at antenatal classes at the national hospital and the private hospital in Tokyo and by the head midwife at the maternity home in Kanagawa. Demographic information was collected, including maternal age, employment status, date of birth of the infant, education, number of children, family structure, and annual income.

The participants completed a baseline survey after signing a consent form, and the data were collected using self-administered paper and pencil surveys on site. Completion of the survey took approximately 10 min. The instruction not to review any material during the baseline survey was given. All of the surveys were pilot tested by 20 pregnant women and mothers with infants and toddlers prior to initiation of the study, and the questionnaires were revised

to improve clarity. The baseline surveys were completed from June 2, 2011 to August 30, 2011.

Each participant received a study identification number and was randomly assigned to one of three groups (two intervention groups and one control group) using a computer generated randomization list that was provided and stratified based on the three enrollment sites upon obtaining consent. Participants were blinded to their group assignment at recruitment and during completion of the baseline questionnaire. Because the intervention was an educational program, blinding the study staff and participants was not possible after the groups were assigned.

Sample size was calculated assuming a completion rate of three vaccines of 10% in the control group, 37 subjects in each study group would be sufficient to detect a completion rate of 40% in the intervention groups with an 80% power and an adjusted type 1 error of 5%.

This study was approved by the Institutional Review Board of the University of Tokyo and the National Center for Child Health and Development.

Intervention

Immunization education was provided for each intervention group during the prenatal or postpartum period. The interventions were conducted in an outpatient setting at the hospital for the prenatal intervention group during weeks 34–36 of gestation and in the hospital wards for the postnatal group 3–6 days after delivery, and the control group did not receive any educational instructions aside from routine check-up visits, which provide instruction only for vaccines under the law. The intervention session consisted of one-on-one interactive educational information on immunization. A single investigator played the role of the educator and covered a wide range of subjects related to immunization. The education session included information on vaccine types, the concept of vaccine-preventable diseases (VPDs), the effectiveness and side effects of vaccines, and the procedure for scheduling infant immunizations in conjunction with the use of an immunization booklet, which outlined all the relevant information, as determined by Japanese immunization specialists, and included an infant immunization schedule issued by the Japan Pediatric Society (2012). The scenario and hypothetical question–answer session were developed in advance. The sessions lasted approximately 10 min.

The post-survey was mailed to all of the participants approximately 100 days after delivery with a 500 yen (approximately 6 U.S. dollar) gift card as an incentive. The control group also received the educational materials when they completed the post-survey and was asked not to review the materials before completing the post-survey.

Outcomes

The primary outcome measure was self-reported up-to-date immunization status for the Hib and HBV vaccines and PCV7 among infants, at age 3 months. The 92-day assessment was used as the standard measure to time the initiation of immunization (Center for Disease Control and Prevention, 1995). The immunization status of each infant was evaluated

between the ages of 62 and 92 days because infant immunization begins at two months of age, as determined by the Japanese Immunization Law (Ministry of Health, Labor and Welfare, Japan, 2012). The secondary outcome was the changes in maternal knowledge, attitudes and beliefs and the intent to immunize as measured by the pre- and post-study questionnaires. All participants were evaluated at the beginning of the study and when the infants were three months of age by self-report. Knowledge about VPDs was measured based on correct selection of 13 VPDs out of 21 communicable diseases that can be acquired by the age of two, with scores ranging from 1 to 13. Basic knowledge related to vaccination was measured using multiple choice items (Supplement Table 1). The number of questions answered correctly were added together to obtain a total knowledge score (maximum of 10). Self-reported knowledge related to an individual understanding of childhood vaccination was evaluated using six items using the Likert scale with scores of 1 (“I don’t know”), 2 (“I know a little”), or 3 (“I know”) (Supplement Table 2).

The Health Belief Model (HBM) (Becker, 1974) and the Integrated Behavioral Model (IBM) (Glanz et al., 2008) were used to assess psychosocial factors using a questionnaire (Painter et al., 2010) that has been used in previous studies (Daley et al., 2007; Glanz et al., 2008; Montano, 1986). Attitudes and beliefs about VPDs and vaccination based on the HBM (Becker, 1974) and the IBM (Glanz et al., 2008) included the perceived severity, perceived susceptibility, perceived benefits, perceived barriers, perceived self-efficacy, injunctive social norms, descriptive social norms, and perceived behavioral controls. All of the items were based on five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree) (Supplement Table 3). The original version was translated from English to Japanese by the investigator and accuracy was confirmed using reverse translation by three individuals who are skilled in the English language. The questionnaires were tested in a pilot study prior to being used.

The question of intent to immunize was measured on a four-point scale with scores of 1 (“no”), 2 (“undecided”), 3 (“yes, for a specific vaccine”), and 4 (“yes”).

Data analysis

Statistical analyses were performed using SPSS version 19.0 (Chicago, IL). All tests were two-tailed with a significance level of 0.05. Descriptive statistics were used to assess the distribution of the background and outcome variables among the survey respondents. We used the Fisher’s exact test to perform bivariate analyses to examine data distributions and associations between variables. The Wilcoxon rank-sum test was used to compare mean scores for Likert scores to measure the secondary outcomes in each study group. The Kruskal–Wallis test was used to compare the mean change in pre- and post-survey scores between the three groups. A logistic regression analysis was used to investigate the influence of independent variables (changes in scores of knowledge, attitude, and belief before and after the intervention) upon HBV vaccination status. Univariable and multivariable analyses were performed. The multivariable analysis included variables that were significant at the 0.10 level in the univariate analysis; the final model was chosen using backwards model selection, with a 0.10 significance threshold for inclusion in the model.

Results

Study participants

Recruitment took two months. We approached 193 pregnant women and 119 (61%) agreed to participate in the study (Fig. 1), with 74 (62.2%) from the national hospital, 28 (24.1%) from a private hospital, and 17 (12.0%) from the maternal hospital. The number of participants in the prenatal, postnatal, and control groups were 37 (31%), 37 (31%), and 45 (38%), respectively. There were no statistically significant differences in the demographics between the three groups (Table 1). Because three participants in the control group did not return the baseline survey, the final number of participants was 116. A total of 106 post-survey questionnaires were returned (response rate: 92%). A detailed flow chart depicting the participants in each group is shown in Fig. 1.

Immunization rates at three months of age

The overall infant immunization rates for the three vaccines during the 92-day follow-up period were higher in the prenatal group (29.4%) and the postnatal group (38.9%) compared to the control group (8.3%) ($P = 0.007$) (Table 2). The two intervention groups combined had a higher rate of vaccination compared to the control group (34.3% vs. 8.3%, $P = 0.005$); however, no differences in immunization rates observed between the intervention groups ($P = 0.40$). When we compared each vaccine, the immunization rate of the HBV vaccine was higher in the intervention groups (34.3%) compared to the control group (11.1%) ($P = 0.02$); however, no significant differences in the vaccination rates of the Hib vaccine ($P = 0.22$) and PCV7 ($P = 0.44$) were observed between the two groups.

Intent to immunize

There was a significant difference in the responses regarding the intent to immunize infants between the intervention and the control group ($P = 0.01$) (Table 3). The percent of participants who answered 'yes' in the questionnaire was higher in the intervention groups (61.4%) compared to the control group (33.3%). This difference was not observed in the pre-test survey (data not shown).

Knowledge

There were significant improvements in all of the knowledge components between the pre- and post-intervention in all three groups ($P = 0.001$) (Table 4). A significant improvement in the basic knowledge regarding immunizations was observed between the three groups. The prenatal group showed the highest gain in scores (3.4 ± 1.8), followed by the postnatal group (2.6 ± 1.5) and the control group (1.9 ± 1.9) ($P = 0.008$) (Table 5). The VPD ($P = 0.97$) and self-knowledge scores ($P = 0.44$) did not change between the three groups. Changes in self-knowledge score was significantly associated with HBV vaccination status ($P = 0.01$) by univariate logistic regression analysis and this remained significant ($P = 0.02$) after controlling for other significant variables (Supplement Table 4).

Attitudes and beliefs

There were several significant improvements in the scores regarding the attitudes and beliefs toward immunization between the pre- and post-interventions. The perceived severity score improved in the prenatal and control groups ($P = 0.01$ and $P = 0.002$, respectively), but not in the postnatal group ($P = 0.18$). The perceived barrier score in the postpartum group increased after the intervention ($P = 0.01$), but not in the prenatal and control groups ($P = 0.79$ and $P = 0.43$, respectively) (Table 4). All of the groups showed higher scores for the injunctive social norm and the descriptive social norm following the intervention ($P < 0.006$). Changes in the scores between the pre- and post-test for each of the attitude and belief components did not change significantly between the three groups ($P = 0.05$) (Table 5).

Perceived behavioral control affected HBV vaccination status ($P = 0.03$) by univariate logistic regression analysis; however, it did not remain significant after controlling for other significant variables (Supplement Table 4).

Discussion

This is the first randomized controlled study to demonstrate the effectiveness of pre- and postnatal immunization education to improve the vaccination status of infants and the knowledge, attitudes, and beliefs of mothers toward immunization. This study indicates that there is an advantage to providing information about immunization during the perinatal period to protect children from VPDs in Japan, where information regarding the immunization schedule during early infancy is limited and financial barriers to recipients exist.

The results of the current study support the importance of immunization education during the perinatal period. A previous study reported that the importance of parenting education program because education in perinatal period improved to complete the scheduled immunization (El-Mnohandes et al., 2003). To improve parental knowledge, several studies have indicated the effects of early intervention in a prenatal care setting (Bjornson et al., 1997; Zuniga de Nuncio et al., 2003). Our study demonstrated that providing general information of infant immunization may have given positive impact on immunization status, knowledge and intent to immunize. As other data suggested (Vannice et al., 2011; Vora et al., 2009), our data also supported the fact that postpartum period is an important period to implement infant immunization education. These previous studies reported that perinatal education had positive effects on immunization status, knowledge, attitudes, and intent to vaccinate, when these variables were considered separately; however, our study showed that perinatal education had a simultaneous positive impact on all the above factors.

In this study, the intervention groups had higher immunization rates of the HBV vaccine compared to the control group. This is probably due to the fact that current HBV vaccination rate is low, estimated $<1\%$. However, no significant differences in the immunization status of the Hib vaccine and PCV7 were observed. A possible explanation is that the government decided to provide a temporary budget for newly introduced vaccines, including the Hib, and HPV vaccines and PCV7, beginning in 2011, which was approximately two months before

the participants were enrolled in the study. More than 90% of local governments offered support for all three of these vaccination fees and provided information to parents on the necessity of these vaccines. As a result, infants could readily receive Hib vaccine and PCV7 during this period, and the distribution rates of both vaccines improved from <10% to 60–70% at 6 months after implementation of the budget, which may explain why there were no differences in vaccination rates with respect to intervention status. Socioeconomic barriers have a significant impact on vaccination rates, and removing these barriers to vaccination is the first step to improving coverage (Diekema, 2012). Our results suggested that financial issue needs to be improved and all childhood vaccinations need to be included in vaccines under the law.

Another factor that may have impacted the results of this study is the dispersion of misleading information by influential individuals, vaccine safety advocates, and some clinicians. For example, the importance of the universal HBV vaccine has not been well communicated in Japan (Komatsu et al., 2009). HBV vaccine has typically been given only to infants of HBsAg-positive mothers. Our encouraging results regarding HBV vaccination suggest that maternal education improves immunization rates, particularly in areas where information is limited.

The knowledge score increased in the pre- and post-surveys between the three groups. It is possible that the participants obtained immunization information from different resources, such as home visits from medical personnel or at the one-month infant check-up by physician. The basic knowledge score significantly differed based on the type of intervention and changes in self-knowledge score were significantly associated with HBV vaccination status. The importance of education during the perinatal period has been confirmed in other studies in which pregnant women who received prenatal educational sessions on immunization demonstrated an improved knowledge regarding various aspects of vaccination (Zuniga de Nuncio et al., 2003). Another study showed that incorporating immunization education into routine prenatal care increased maternal knowledge regarding infant vaccines and reduced delayed immunization (Navar et al., 2007). Additional studies are necessary to clarify the improvement in knowledge regarding immunization as it relates to improved vaccination rates.

Several factors need to be considered when analyzing the data in this study. First, the sample size was small, which decreased the likelihood of detecting potential differences. Second, the introduction of temporary budget during this study period increased the vaccination rates of the Hib vaccine and PCV7, which can confound the study results. Additionally, a television commercial for the PCV7 was aired during the study period in Japan, which emphasized the necessity of the PCV7 and may have reduced the impact of the intervention. Third, the study participants were well-educated and had a high socioeconomic status and had the ability to obtain information related to immunization on their own through a variety of resources, which might have affected the outcome of our intervention. Although we compared the resources about infant immunization, no difference was identified. Furthermore, since not only educational background and remuneration differs, but also immunization policy and practice vary between countries, the results of this study may not be generalizable. Fourth, attendance at antenatal classes was voluntary, and enrollment in the

study was solely at the discretion of the participants. In addition, a few participants from the control group withdrew from the study. As such, it is possible that pregnant women who were uninterested in immunization, or less active in child health, did not enroll in the study. This group may be a more important target population for this study. Fifth, we need to consider the self-report bias (Adams et al., 1999), which can result in an inflation of behavioral intention. Sixth, during this study period, the media reported on an oral polio vaccine that can cause vaccine-associated polio paralysis, which led to increase the attention of parents toward the safety rather than the importance of immunization, which may have played a role in differences in the attitudes and beliefs toward immunization. Lastly, the follow-up period of the study was only three months. A longer observation period may highlight differences in the immunization completion rates.

Conclusions

Pre- and postnatal immunization education in pregnant women in Japan improved the immunization rates of infants and increased the intent to vaccinate infants and the maternal knowledge regarding immunization. Future research is necessary to investigate the optimal timing and content of immunization education and develop a standard education program with related materials to encourage the immunization of infants in Japan.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Appendix A

CONSORT 2010 checklist of information to include when reporting a randomised trial*

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract	1a	Identification as a randomised trial in the title	1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	3
Introduction			
Background and	2a	Scientific background and explanation of rationale	4
objectives	2b	Specific objectives or hypotheses	5
Methods			

Section/Topic	Item No	Checklist item	Reported on page No
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	6
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	none
Participants	4a	Eligibility criteria for participants	6
	4b	Settings and locations where the data were collected	6
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were	7
Outcomes	6a	actually administered Completely defined pre-specified primary and secondary outcome measures, including how and when they	8–9
	6b	were assessed Any changes to trial outcomes after the trial commenced, with reasons	none
Sample size	7a	How sample size was determined	7
	7b	When applicable, explanation of any interim analyses and stopping guidelines	none
Randomisation:			
Sequence	8a	Method used to generate the random allocation sequence	6
Generation	8b	Type of randomisation; details of any restriction (such as blocking and block size)	6
Allocation	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers),	6
Concealment		describing any steps taken to conceal the sequence until interventions were assigned	
Mechanism			
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to	6
Blinding	11a	interventions If done, who was blinded after assignment to interventions (for example, participants, care providers, those	7
	11b	assessing outcomes) and how If relevant, description of the similarity of interventions	Page 1 none
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	9
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	none
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and	11
	13b	were analysed for the primary outcome For each group, losses and exclusions after randomisation, together with reasons	11
Recruitment	14a	Dates defining the periods of recruitment and follow-up	6
	14b	Why the trial ended or was stopped	none
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	Table 1
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was	11, Figure 1

Section/Topic	Item No	Checklist item	Reported on page No
Outcomes and estimation	17a	by original assigned groups For each primary and secondary outcome, results for each group, and the estimated effect size and its	11–13
	17b	precision (such as 95% confidence interval) For binary outcomes, presentation of both absolute and relative effect sizes is recommended	none
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing	none
Harms	19	pre-specified from exploratory All important harms of unintended effects in each group (for specific guidance see CONSORT for harms)	none
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and if relevant, multiplicity of analyses	16–17
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	16
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	14–16
Other information			
Registration	23	Registration number and name of trial registry	3
Protocol	24	Where the full trial protocol can be accessed, if available	none
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	18

Abbreviations:

VPD	Vaccine preventable diseases
PCV7	seven-valent pneumococcal conjugate vaccine
Hib	<i>Haemophilus influenzae</i> type b
HBV	hepatitis B virus
HPV	human papilloma virus
HBM	the Health Belief Model
IBM	the Integrated Behavioral Model

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Fig. 1.
Flow chart of the study participants.

Table 1

Characteristics of study participants.

	Prenatal (n = 34)	Postpartum (n = 36)	Control (n = 36)	P-value
Age (mean SD)	35.5 ± 5.2	35.9 ± 4.6	34.7 ± 3.8	0.52 ^a
School level				
Middle/high school	3 (8.8)	6 (16.7)	4 (11.1)	0.68 ^c
Junior college	12 (35.3)	8 (22.2)	13 (36.1)	
University	19 (55.9)	22 (61.1)	19 (52.8)	
Numbers of children				
0	30 (88.2)	35 (97.2)	28 (77.8)	0.07 ^c
1	4 (11.8)	1 (2.8)	5 (13.9)	
2	0 (0.0)	0 (0.0)	3 (8.3)	
Maternal employment status				
Unemployed	20 (58.8)	13 (36.1)	13 (36.1)	0.15 ^c
Employed	14 (41.2)	23 (63.9)	23 (63.9)	
Household annual income (thousand yen)				
2000–3999	6 (17.6)	4 (11.1)	2 (5.6)	0.50 ^b
4000–5999	4 (11.8)	6 (16.7)	5 (13.9)	
6000–7999	2 (5.9)	5 (13.9)	6 (16.7)	
8000–9000	8 (23.5)	11 (30.6)	6 (16.7)	
10,000	13 (38.2)	10 (27.8)	14 (38.9)	

Numbers in parenthesis shows percentages in each group.

^aANOVA.^bKruskal–Wallis test.^cFisher's exact test.

Table 2

Immunization status after intervention among three groups.

	Prenatal (n = 34)	Postpartum (n = 36)	Control (n = 36)	P-value ^a	Intervention ^b (n = 70)	Control (n = 36)	P-value ^c
Immunization status							
Completed three vaccines	10 (29.4)	14 (38.9)	3 (8.3)	0.007 ^e	24 (34.3)	3 (8.3)	0.005 ^e
Number of completed vaccination (range: 0–3)	2.2 ± 0.6	2.3 ± 0.7	1.9 ± 0.7	0.02 ^d	2.2 ± 0.6	1.9 ± 0.7	0.01 ^f
Types of vaccination							
<i>Haemophilus influenzae</i> type b (Hib)	32 (94.1)	35 (97.2)	32 (88.9)	0.44 ^e	67 (95.7)	32 (88.9)	0.22 ^e
Conjugated seven-valent pneumococcal (PCV7)	32 (94.1)	34 (94.4)	32 (88.9)	0.73 ^e	66 (94.3)	32 (88.9)	0.44 ^e
Hepatitis B virus (HBV)	10 (29.4)	14 (38.9)	4 (11.1)	0.02 ^e	24 (34.3)	4 (11.1)	0.02 ^e

Numbers: n (%) or mean ± S.D.

^aComparison between the three groups.^bCombination of prenatal and postpartum.^cComparison between the intervention group and control group.^dKruskal–Wallis test.^eFisher's exact test.^fOne-sample Wilcoxon rank-sum test.

Table 3

Intention to receive vaccines after intervention among three groups.

	Prenatal (n = 34)	Postpartum (n = 36)	Control (n = 36)	P-value ^a	Intervention ^b (n = 70)	Control (n = 36)	P-value ^c
Intention to receive vaccines							
No/undecided	0	0	0		0	0	
Yes, for sure	18 (52.9)	25 (69.4)	12 (33.3)	0.03 ^d	43 (61.4)	12 (33.3)	0.01 ^d
Yes, for specific vaccine	9 (26.5)	7 (19.4)	18 (50.0)		16 (22.9)	18 (50.0)	
No answer	7 (20.6)	4 (11.2)	6 (16.7)		11 (15.7)	6 (16.7)	

Numbers: n (%) or mean $\pm$ S.D.

^aComparison between the three groups.

^bCombination of prenatal and postpartum.

^cComparison between the intervention group and control group.

^dFisher's exact test.

Table 4

Scores of knowledge, attitudes and beliefs between pre-test and post-test among three groups.

	Range	Prenatal (n = 34)		P-value ^a	Postpartum (n = 36)		P-value ^a	Control (n = 36)		P-value ^a
		Pre-test	Post-test		Pre-test	Post-test		Pre-test	Post-test	
Knowledge										
VPD score	1–13	6.7 ± 2.9	11.2 ± 1.8	0.001 [*]	6.0 ± 2.7	10.6 ± 2.4	0.001 [*]	5.6 ± 3.2	10.1 ± 2.4	0.001 [*]
Self-knowledge	1–12	4.0 ± 3.9	9.9 ± 2.1	0.001 [*]	2.7 ± 2.5	9.7 ± 2.2	0.001 [*]	3.6 ± 3.0	9.7 ± 1.9	0.001 [*]
Basic knowledge										
Attitudes and beliefs	1–10	6.2 ± 1.7	9.5 ± 0.9	0.001 [*]	6.7 ± 1.4	9.3 ± 1.0	0.001 [*]	6.9 ± 1.6	8.8 ± 1.4	0.001 [*]
Perceived severity (HBM)	2–10	7.9 ± 1.3	8.6 ± 1.3	0.01 [*]	7.6 ± 1.4	7.9 ± 2.0	0.18	7.0 ± 2.1	8.2 ± 1.5	0.002 [*]
Perceived susceptibility (HBM)	1–5	1.9 ± 1.1	1.9 ± 1.1	0.84	1.9 ± 1.0	1.8 ± 1.0	0.79	2.0 ± 1.0	2.1 ± 1.1	0.36
Perceived benefit (HBM)	4–20	11.5 ± 3.5	11.5 ± 6.6	0.22	10.3 ± 4.0	10.4 ± 4.6	0.82	10.1 ± 3.9	11.4 ± 8.6	0.46
Perceived barriers (HBM)	5–25	13.4 ± 3.4	13.2 ± 4.1	0.79	12.3 ± 3.1	13.2 ± 4.0	0.01 [*]	11.7 ± 3.2	13.1 ± 8.4	0.43
Self-efficacy (HBM)	2–10	7.2 ± 1.2	7.5 ± 1.3	0.16	7.2 ± 1.7	7.5 ± 1.5	0.19	7.9 ± 0.9	7.5 ± 1.8	0.16
Perceived behavioral control (IBM)	1–5	3.4 ± 1.0	3.9 ± 1.7	0.06	3.4 ± 1.2	3.7 ± 1.2	0.26	3.7 ± 1.0	3.6 ± 1.5	0.57
Social norm (injunctive)	4–20	16.0 ± 2.5	17.5 ± 2.7	0.003 [*]	15.9 ± 3.2	17.5 ± 2.3	0.001 [*]	16.4 ± 2.4	18.4 ± 2.1	0.001 [*]
Social norm (descriptive)	2–10	7.9 ± 1.6	9.4 ± 1.0	0.001 [*]	8.1 ± 2.0	9.2 ± 1.5	0.005 [*]	8.1 ± 2.5	9.2 ± 1.5	0.006 [*]

Numbers: mean ± S.D.

VPD: Vaccine Preventable Diseases, HBM: Health Belief Model, IBM: Integrated Behavioral Model.

^aOne-sample Wilcoxon rank-sum test.

* p<0.01.

Table 5

Changing in scores of knowledge, attitudes and beliefs from pre-test to post-test among three groups.

	Range	Prenatal (n = 34)	Postpartum (n = 36)	Control (n = 36)	P-value ^a
Knowledge					
VPD score	1–13	4.5 ± 2.8	4.5 ± 2.9	4.6 ± 3.8	0.97
Self-knowledge	1–12	5.9 ± 2.8	6.9 ± 2.7	6.2 ± 2.8	0.44
Basic knowledge	1–10	3.4 ± 1.8	2.6 ± 1.5	1.9 ± 1.9	0.008*
Attitudes and beliefs					
Perceived severity (HBM)	2–10	0.8 ± 1.5	0.3 ± 1.9	1.3 ± 2.2	0.37
Perceived susceptibility (HBM)	1–5	0.03 ± 1.3	−0.03 ± 0.8	0.2 ± 0.9	0.39
Perceived benefit (HBM)	4–20	−0.2 ± 6.6	0.2 ± 4.2	1.4 ± 7.6	0.33
Perceived barriers (HBM)	5–25	−0.2 ± 3.6	0.8 ± 3.4	1.5 ± 7.6	0.40
Self-efficacy (HBM)	2–10	−0.2 ± 1.6	0.3 ± 1.3	−0.4 ± 1.3	0.05
Perceived behavioral control (IBM)	1–5	0.4 ± 1.3	0.3 ± 1.6	−0.1 ± 1.3	0.32
Social norm (injunctive)	4–20	1.5 ± 2.4	1.7 ± 2.7	1.8 ± 2.5	0.86
Social norm (descriptive)	2–10	1.5 ± 1.9	1.1 ± 2.3	1.2 ± 2.4	0.39

Numbers: mean ± S.D.

HBM: Health Belief Model, IBM: Integrated Behavioral Model.

^aKruskal–Wallis test.

* p<.01.