Knowledge, Attitudes, and Practices (KAP) of vaccinators for Non-national Immunization Program (non-NIP) Vaccines in Primary Healthcare Vaccination Institutions across Yunnan, Liaoning, Hubei and Guangdong Provinces in China: a Case Study of 13-Valent Pneumococcal Conjugate Vaccine (PCV13)

by

Keyi Huang

DKU Global Health Program
Duke University

Date:___April 2, 2024_____

Approved:

___ Shenglan Tang, Supervisor____

_____ Qian Long_____

_____ Yu Wang_____

Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
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Abstract

Background: Understanding the KAP of vaccinators towards non-NIP vaccines is crucial, especially in a country as populous and diverse as China. This study focuses on the 13-valent pneumococcal conjugate vaccine (PCV13), highlighting the importance of this vaccine in preventing diseases like pneumonia, which poses a significant health threat to children under five years of age.

Methods: Conducted in four provinces—Yunnan, Liaoning, Hubei, and Guangdong—this mixed-methods study combines quantitative data from 419 healthcare professionals with qualitative insights from 13 in-depth interviews. Measures focused on assessing KAP related to PCV13, with analysis leveraging multivariate linear regression and thematic analysis.

Results: The study revealed high levels of knowledge among vaccinators about the PCV13 vaccine, with variability in attitudes and practices observed across provinces. While a significant portion of healthcare professionals demonstrated a proactive stance in recommending vaccines in their professional capacity, a notable discrepancy was observed in their personal practices, particularly concerning the vaccination of their own children with PCV13.

Conclusions: This investigation underscores the complexities surrounding the KAP of vaccinators towards non-NIP vaccines in China. Identifying systemic factors affecting PCV13 implementation and addressing discrepancies between professional

recommendations and personal practices are crucial steps toward improving vaccination rates.

Dedication

To my family, for their unwavering support and belief in my potential, and to my mentors, who have guided me with wisdom and patience—this journey is as much yours as it is mine.

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Acknowledgements

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This journey has been one of collaborative effort, and I am humbled by the contributions of all those who have been a part of it. Thank you for being integral to this milestone in my academic career.

1. Introduction

Vaccination stands as one of the most significant public health achievements, offering a cost-effective strategy for saving lives and enhancing health and well-being[1]. In China, the implementation of the National Immunization Program (NIP) since 1978 has been a cornerstone in the effort to prevent and control infectious diseases among children[2]. The NIP has successfully facilitated widespread childhood immunization, significantly reducing the burden of vaccine-preventable diseases nationwide.

However, in China beyond the scope of NIP vaccines, which are provided freely to eligible children, lies the realm of non-NIP vaccines[3]. These vaccinations are voluntary and self-funded by individuals. They act as supplement to the NIP vaccines, addressing a range of essential infectious diseases, including HPV and 13-valent pneumococcal conjugate vaccine (PCV13)[4].

The role of non-NIP vaccines, such as the PCV13, is increasingly vital in the broader landscape of public health. Statistics from 1980 to 2008 reveal that the incidence and mortality rates for pneumonia among children under five years old were 12815/100,000 person-years (8625-18623/100,000 person-years) and 526/100,000 person-years (262-1053/100,000 person-years) respectively[5]. These figures underscore the significant health challenges posed by pneumonia among Chinese children, particularly in relation to bacterial meningitis.

Recent clinical data highlights Streptococcus pneumoniae as a major pathogen in children, particularly among those aged over three months, where the infection rate reaches 54.7%[6]. The Global Burden of Disease Study[3] estimated that in 2016, pneumococcal meningitis resulted in 606.4 deaths in China, with a mortality rate of 0.04 per 100,000 person-years, causing a substantial loss of 52,300 life-years[7].

Pneumococcal Conjugate Vaccine 13 (PCV13) exhibits exceptional immunogenicity and tolerability among Chinese infants and young children. Particularly, the immunization program beginning at six weeks of age not only provides significant protection to children but also extends to adults[8]. Incorporating PCV13 into China's childhood immunization schedule could prove to be a crucial strategy in preventing and controlling diseases associated with Streptococcus pneumoniae.

According to the World Health Organization, out of 147 countries that have included the Pneumococcal Conjugate Vaccine (PCV) in their national immunization programs, 51 are high-income countries with the highest coverage rate of 34.69%, and 41 are low-income countries with a coverage rate of 27.89%[9]. However, in China, free PCV immunization policies are limited and region-specific.

In China's mainland, there are few places where PCV free immunization policies implemented. Weifang City, Shandong Province is one exceptional place where children under six years older are offered free of the first doze of PCV13[10].

Given the pivotal role of vaccinators in the dissemination and success of vaccination programs, understanding their Knowledge, Attitudes, and Practices (KAP) towards non-National Immunization Program (non-NIP) vaccines is of paramount importance. The significance of studying KAP extends beyond mere academic inquiry—it directly influences public health outcomes. For example, a study[11] highlights the correlation between healthcare professionals' knowledge of vaccines and their willingness to recommend them, underlining the critical role of knowledge in vaccination behaviors. Similarly, Patel and Nowalk[12] demonstrate that positive attitudes towards vaccines among healthcare providers significantly increase the likelihood of vaccine recommendations to patients.

In examining the Knowledge, Attitudes, and Practices (KAP) of vaccinators towards non-NIP vaccines, our study acknowledges the intricate diversity of provinces like Yunnan, Liaoning, Hubei, and Guangdong in China[13]. These regions, each with their unique socio-economic, cultural, and health infrastructure landscapes, offer a rich context for exploring vaccine administration practices. It is within these varied settings that the nuances of vaccine delivery and acceptance become most apparent, underscoring the importance of a region-specific approach in understanding, and enhancing immunization efforts. As such, this research endeavors to delve into these regional specificities, aiming to uncover the layered and complex factors that influence vaccinators' practices and perceptions in these distinct provinces.

Recent KAP studies on vaccines in China have provided valuable insights into public and healthcare professionals' perspectives towards both NIP (National Immunization Program) and non-NIP vaccines. For instance, research among young workers in South China and older adults during the COVID-19 pandemic revealed a discrepancy between positive beliefs in vaccine efficacy and actual vaccination rates, underscoring a significant gap between knowledge and practice. Additionally, an online survey highlighted an increased awareness of influenza among Chinese adults during the COVID-19 epidemic, yet also revealed misconceptions about the impact of influenza compared to COVID-19, pointing towards gaps in knowledge and the need for targeted educational campaigns[1415].

This study aims to fill the existing knowledge gap by investigating the KAP of vaccinators towards the PCV13 vaccine in primary healthcare vaccination institutions across the provinces. This investigation is not only critical for understanding the current state of vaccine administration but also essential for identifying potential barriers and facilitators in the adoption of non-NIP vaccines.

To expedite the inclusion of PCV13 vaccine into the childhood immunization program in China, we aim to explore the KAP from healthcare providers in China.

Aim1: To evaluate Knowledge, Attitudes, and Practices (KAP) of Vaccinators: The overarching goal of this proposal is to comprehensively assess the Knowledge, Attitudes, and Practices (KAP) of vaccinators working in Primary Healthcare

Vaccination Institutions in China concerning the PCV13 vaccine. This inclusive evaluation will cover their understanding of the vaccine's composition, indications, contraindications, dosage, and potential side effects. Simultaneously, we will explore their attitudes and perceptions towards the importance, safety, and effectiveness of PCV13, as well as their willingness to recommend and administer it to eligible children. Additionally, the study aims to observe and document the actual practices of vaccinators in administering PCV13, assessing their adherence to established vaccination protocols, including proper handling, storage, and delivery of the vaccine, while identifying any challenges or barriers they encounter in the process.

Aim 2: To Identify Systemic Factors Affecting PCV13 Implementation: We will focus on identifying and analyzing broader systemic factors that impact the implementation of PCV13 in Primary Healthcare Vaccination Institutions in China. By examining logistical challenges, resource availability, policy frameworks, and communication strategies, understanding these systemic factors will provide valuable insights into the overarching determinants influencing the successful integration of PCV13 into routine immunization practices.

2. Methods

Overview design of the study

The study employed a mixed-methods approach, integrating qualitative and quantitative data. Qualitative data were gathered through in-depth interviews with 13 healthcare professionals, conducted by trained interviewers from Fudan University. These interviews were held at the participants' workplaces. Quantitative data were collected online, using a structured questionnaire distributed electronically to 419 healthcare professionals across Yunnan, Liaoning, Hubei, and Guangdong provinces. After applying inclusion criteria, A from 345 respondents were analyzed.

2.1 Setting

The research was conducted across various primary healthcare vaccination institutions and Centers for Disease Control and Prevention (CDC) across four provinces in Yunnan, Liaoning, Hubei, and Guangdong provinces. These provinces were strategically selected by the Fudan team to represent the north (Liaoning), middle (Hubei), southeast (Guangdong), and southwest (Yunnan) regions of China, encompassing a wide range of socio-economic and cultural backgrounds. This deliberate selection provides a comprehensive view of vaccination practices across different geographical areas, offering valuable insights into the diverse healthcare landscapes within the country.

Yunnan Province

Located in the far southwest of China, Yunnan is renowned for its diverse ethnic composition and complex topography. With a GDP of approximately $421.6 billion and a growth rate of 4.4%, Yunnan's economy reflects its significant agricultural base in the primary sector. This GDP figure positions Yunnan as one of the less developed regions within China, considering the national GDP reached about $17.52 trillion in 2023[16]. The healthcare system in Yunnan faces challenges due to the province's mountainous terrain, which impacts accessibility to healthcare services, particularly in remote areas.

Liaoning Province

Situated in the northeast of China, Liaoning is an industrial powerhouse with a relatively higher urban population compared to Yunnan. The province's economy, with a GDP of 769.41 billion RMB for Q3 2023, when converted using an approximate average exchange rate of 7.00 RMB to 1 USD, equates to about 109.92 billion USD. This economic figure underscores Liaoning's significant role in China's industrial sector and urban development[17].

Hubei Province

Located in central China, Hubei is a pivotal industrial and agricultural hub, with its capital, Wuhan, becoming widely known during the COVID-19 pandemic. The province's GDP reached $205.14 billion by June 2023, showcasing economic resilience and growth. When considering the healthcare landscape, Hubei features a mix of urban and rural facilities, reflecting disparities in access and quality. This economic and

healthcare backdrop underscores Hubei's critical role in China's broader socio-economic structure, highlighting ongoing development and the need for targeted improvements in healthcare distribution.

Guangdong Province

In 2023, Guangdong's GDP reached 13.57 trillion yuan (approximately $1.89 trillion), demonstrating a year-on-year growth of 4.8%[18]. This achievement marked Guangdong as the first province in China to exceed a GDP of 13 trillion yuan, maintaining its leading position in provincial GDP rankings for 35 consecutive years. This economic milestone underscores Guangdong's pivotal role as a manufacturing heartland and a major player in foreign trade within the country. The province's economic output is significant, accounting for about one-tenth of China's total GDP[19]. Despite its economic prowess, Guangdong exhibits disparities in healthcare access between its bustling urban centers, like Guangzhou and Shenzhen, and its rural areas. While urban regions enjoy high-quality healthcare services supported by a dense network of hospitals and clinics, rural Guangdong confronts challenges in healthcare delivery and access to preventive services, including vaccinations for non-NIP vaccines like the PCV13.

2.2 Participants

Participants for the qualitative interviews were recruited from primary healthcare vaccination institutions and CDC across four provinces: Yunnan, Liaoning,

Hubei, and Guangdong in China. The qualitative component involved interviews with 13 healthcare professionals, including CDC staff and community health center medical personnel.

In the quantitative phase of our study, we employed a targeted survey approach, focusing on healthcare professionals who fulfilled two key inclusion criteria: (1) possessing the necessary qualifications to administer vaccinations, and (2) having experience in vaccinating children within a medical setting over the previous year. To refine our data collection process and enhance its relevance, we selected a representative county from each study area. The survey was disseminated through WeChat groups frequented by local vaccination staff, leveraging existing professional networks to facilitate participation. This method, while efficient, may introduce a selection bias, as it relies on the assumption that these groups are representative of the broader healthcare professional community involved in vaccination. Recognizing this potential limitation, we made efforts to mitigate bias by ensuring a wide distribution within each selected county's professional circles. From the 419 respondents, 345 met our stringent inclusion criteria and were subsequently incorporated into the quantitative analysis.

Participants were informed about the study's purpose, and informed consent was obtained prior to their participation. Confidentiality and anonymity of participants were maintained throughout the study.

2.3 Procedures

Quantitative data for this study were collected through a structured questionnaire, designed to capture a comprehensive range of variables relevant to the vaccination practices among healthcare professionals. The questionnaire was distributed electronically, leveraging the accessibility and efficiency of online platforms to reach a broad audience. A total of 419 healthcare professionals from diverse medical institutions across Yunnan, Liaoning, Hubei, and Guangdong provinces were invited to participate. The selection of participants was guided by specific inclusion criteria to ensure the relevance and reliability of the data. Following this screening process, data from 345 respondents who met these criteria were analyzed to glean insights into current vaccination practices.

In parallel, qualitative insights were gathered through structured interviews, offering a deeper exploration of the experiences and perceptions of healthcare professionals in their vaccination duties. These interviews were conducted in the participants' workplaces, providing a conducive and relevant setting for open and detailed discussions. The choice of workplace interviews was intended to facilitate a comfortable environment for participants, potentially leading to more candid and insightful responses. This mixed-methods approach, combining the breadth of quantitative data with the depth of qualitative narratives, was designed to provide a

comprehensive understanding of vaccination practices among healthcare professionals in the selected regions.

The semi-structured interview guide for qualitative data collection was pre-tested for clarity. The quantitative survey underwent a similar pilot testing phase with a subset of the target population to refine and ensure the comprehensibility of the questions. Data collectors received comprehensive training on the study protocol and ethical conduct. All study procedures were approved by the ethical review boards at Duke Kunshan University

2.4 Measures——KAP from vaccinators

2.4.1 Knowledge Assessment

The knowledge component was assessed using a structured questionnaire, which included questions regarding the vaccinators' understanding of the 13-valent pneumococcal conjugate vaccine (PCV13), its dosage, and administration guidelines.

To quantify the knowledge level, we incorporated six questions within the questionnaire. Participants' responses were scored on a binary scale, where a correct answer was awarded one point, and an incorrect answer received none, with no negative scoring implemented. The total score derived from these questions, ranging from 0 to 6, was used to create an index that reflects each participant's level of

knowledge about PCV13. The questionnaire was adapted from previous validated studies on vaccine knowledge[20].

The summary of the content covered by each question included KAP Definition and Burden, Effectiveness of PCV13 Vaccine, Pneumonia Mortality Rate, Preventive Role of PCV13 Vaccine, Vaccine Cost Payment Options, PCV13 Vaccination Schedule.

Example question: " Pneumonia accounts for up to 28% of deaths in children under the age of 5, and it is the second leading cause of death in this age group. (Correct/ Incorrect) "The specific statements and response options are detailed in Appendix A.

Each correct response was scored as one point, allowing for a maximum score of six. To examine regional variations in knowledge, a one-way ANOVA was conducted across different locations in Stata, enabling the identification of significant differences in vaccine knowledge among the studied regions.

2.4.2 Attitude Assessment

Attitudes towards non-National Immunization Program (NIP) vaccines, with a particular focus on PCV13, were assessed through a series of questions designed to capture a comprehensive view of healthcare professionals' perceptions. The initial three questions employed a five-point scale to evaluate perceptions of vaccine coverage, necessity, and personal beliefs regarding vaccine efficacy and responsibility. These were not strictly aligned with a traditional Likert scale of "strongly disagree" to "strongly

agree" but were adapted to fit the context of each question, such as rating the necessity of vaccination or agreeing with statements about vaccine outcomes.

The fourth question, designed as a multi-select item, aimed to identify various factors influencing patients' willingness to receive the PCV13 vaccine, such as promotional activities, knowledge levels, vaccine cost, personal beliefs, and other pertinent factors. This scale was based on modifications from existing attitude scales[21].

Sample Question: "I believe that the PCV13 vaccine is essential for child health." The specific statements and response options are detailed in Appendix A.

Attitudinal responses were quantitatively analyzed. Questions 1, 2, 3, and 7 were structured as ordinal variables with responses ranging from strong disagreement to strong agreement or similar scales. Question 4 allowed for multiple selections from nominal options to identify factors perceived to influence patient vaccination willingness. Questions 5 and 6 were binary, assessing the perceived impact of price on vaccination uptake and the likelihood of recommending the vaccine with a price reduction.

Reliability: The Cronbach's alpha for the attitude scale was xxx.

2.4.3 Practice Assessment

Practices regarding the PCV13 vaccine were evaluated through inquiries focusing on the routine and consistency of vaccine administration by healthcare professionals. This encompassed queries about adherence to vaccination schedules, as

outlined by the World Health Organization, and broader practices such as vaccine advocacy among personal networks.

Sample Question: "Have you recommended pneumonia-related vaccines to your friends, family, or relatives?" (Options: Recommended/Not Recommended/Unsure). Detailed questions and response categories can be found in Appendix A.

Transformation for Analysis: Responses were quantitatively and qualitatively analyzed. This practice of recommending vaccines serves not only as an indicator of vaccine administration consistency but also as a proxy for the underlying attitudes of healthcare professionals towards vaccination.

Description: Practices were assessed through questions that explored the frequency and consistency of PCV13 vaccine administration by healthcare professionals. This included questions on adherence to vaccination schedules and guidelines. The measure was developed based on the practices outlined by the World Health Organization.

Sample Question: " Have you recommended pneumonia-related vaccines to your friends, family, or relatives?"（Recommended/Not Recommended/Unsure）The specific statements and response options are detailed in Appendix A.

Transformation for Analysis: The responses were coded to reflect the prevalence of recommending behavior to vaccination practices.

2.4.3 Statistical Analyses

To examine the relationships and factors associated with the Knowledge, Attitudes, and Practices (KAP) towards the PCV13 vaccine among vaccinators in Primary Healthcare Vaccination Institutions across selected provinces, we utilized Stata 17.0. Quantitative data were described using mean (M) and standard deviation (SD) for continuous variables, and frequencies (percentage %) for categorical variables.

Multivariate linear regression analyses were conducted to identify significant predictors of KAP scores. This approach allowed us to control for potential confounding variables and to explore the direct influence of individual factors (e.g., demographic characteristics, work experience, and region) on the KAP outcomes.

All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant. This comprehensive statistical framework enables a nuanced understanding of the determinants impacting KAP towards PCV13 vaccination among healthcare professionals, informing targeted interventions to enhance vaccine uptake and public health outcomes.

2.4.5 Ethical Considerations

This study was conducted in full accordance with the ethical standards of the Institutional Review Board (IRB) at Duke Kunshan University. Prior to the initiation of the research, the IRB reviewed and approved the study protocol, consent forms, and all participant materials to ensure the protection of participants' rights and welfare. The

study was granted IRB approval on June 13, 2023, with the reference number FWA00021580.

3. Results

3.1 Quantitative Analysis Section

3.1.1 Demographic characteristics

The demographic characteristics of vaccinators in primary healthcare settings of the four provinces are presented in Table 1. The total sample included 345 vaccinators, with provincial representations as follows: Liaoning (n=108, 31.3%), Yunnan (n=70, 20.3%), Hubei (n=58, 16.8%), and Guangdong (n=109,31.6 %).

Age distribution among the respondents indicated that 7.5% were aged 18-25, 42.0% between 26-35, 35.9% were 36-45, and 14.5% were 46 years or above. Disparities across provinces were statistically significant ($p<0.001$), with Yunnan having the highest percentage (22.9%) of the youngest age group (18-25 years) and Hubei having the highest percentage (25.9%) of the oldest age group (46 and above).

Sex distribution was markedly skewed towards female vaccinators, who constituted 87.8% of the total sample. Provincial differences were significant ($p<0.001$), with Liaoning having the highest proportion of female vaccinators (96.3%).

Regarding educational levels, 61.5% of the total respondents had attained a college-level education or higher. The variance in educational attainment across the provinces was statistically significant ($p<0.001$), with Guangdong reporting the highest percentage (87.2%) of vaccinators with a college degree or above.

The vaccinator's working experience was diverse: 23.2% had less than 5 years of experience, 28.1% between 6-10 years, 20.0% had 11-15 years, and 28.7% had more than 16 years of experience. These distributions varied significantly across provinces ($p<0.001$), with Hubei having the highest proportion (39.7%) of vaccinators with more than 16 years of experience.

Income levels also showed significant provincial differences ($p<0.001$). Overall, 56.2% of the respondents earned above 50,000 yuan. Liaoning had the highest percentage (61.1%) of vaccinators earning below 50,000 yuan, while Guangdong had the highest proportion (95.4%) earning above 50,000 yuan.

The majority of vaccinators were of Han ethnicity (92.2%), with significant differences across provinces ($p<0.001$). Hubei had the only sample with 100% Han ethnicity, while Yunnan had the highest percentage of non-Han vaccinators (15.7%).

Table1: Demographic Characteristics of vaccinators among vaccinators in Primary Healthcare Settings

	Total (n=345)	**Respondents Across Four Provinces**				**P value**
		Liaoning (n=108)	**Yunnan** (n=70)	**Hubei** (n=58)	**Guangdong** (n=109)	
Age in groups, n						<0.001
18 – 25	26(7.5%)	5(4.6%)	16(22.9%)	2(3.5%)	3(2.8%)	
26 – 35	145(42.0%)	54(50.0%)	33(47.1%)	22(37.8%)	36(33.0%)	
36 – 45	124(35.9%)	33(30.6%)	13(18.6%)	19(32.8%)	59(54.1%)	
46 and above	50(14.5%)	12(14.8%)	8(11.4%)	15(25.9%)	11(10.1%)	
Sex, n						<0.001
Male	42(12.2%)	4(3.7%)	10(14.3%)	4(6.9%)	24(22.0%)	
Female	303(87.8%)	104(96.3%)	60(85.7%)	54(93.1%)	85(78.0%)	
Education level, n						<0.001
High school	28(8.1%)	7(6.5%)	7(10.0%)	13(22.4%)	1(0.9%)	
Junior College	105(30.4%)	29(26.9%)	41(58.6%)	22(37.9%)	13(11.9%)	
College and above	212(61.5%)	72(66.7%)	22(31.4%)	23(39.7%)	95(87.2%)	
Working experiences, n (%)						<0.001
≤5 years	80(23.2%)	18(16.7%)	32(45.7%)	12(20.7%)	18(16.5%)	
6 years -10 years	97(28.1%)	37(34.2%)	19(27.1%)	17(29.3%)	24(22.0%)	
11 years -15 years	69(20.0%)	26(24.1%)	9(12.9%)	6(10.3%)	28(25.7%)	
≥16 years	99(28.7%)	27(25.0%)	10(14.3%)	3(39.7%)	39(35.8%)	
Income level, n (%)						<0.001
< 50,000	151(43.8%)	66(61.1%)	47(67.1%)	33(56.9%)	5(4.6%)	
≥50,000	194(56.2%)	42(38.9%)	23(32.9%)	25(43.1%)	104(95.4%)	
Ethnicity, n (%)						<0.001
Han	318(92.2%)	93(86.1%)	59(84.3%)	58(100.0%)	108(99.1%)	
Non-Han	27(7.8%)	15(13.9%)	11(15.7%)	0	1(0.9%)	

The Work-related information of vaccinators in primary healthcare settings across the four provinces in our study are summarized in Table 3. The average working time among all respondents was 22.62 hours per week. When analyzed provincially, Liaoning reported an average working time of 12.58 hours per week, Yunnan 20.44 hours per week, Hubei 32.21 hours per week, and Guangdong 28.90 hours per week. Statistical analysis indicated a significant difference in the average working time across provinces ($p<0.001$)

In terms of the mean number of doses injected in the past year, the overall average was 3147.17. Liaoning vaccinators reported administering an average of 2020.36 doses, Yunnan 655.24, Hubei 2132.78, and Guangdong 6034.66. The variation in doses administered was also statistically significant ($p<0.001$).

The period until the last training among the total respondents revealed that 77.7% had training in less than 6 months, 14.2% between 6 to 12 months, and 8.1% had their last training more than a year ago. The provincial breakdown is as follows: In Liaoning, 83.3% had training in less than 6 months, 10.2% between 6 to 12 months, and 6.5% more than a year ago. Yunnan had 75.7%, 21.4%, and 2.9% in the respective categories. Hubei reported 93.1%, 6.9%, and no data available for training more than a year ago. Finally, Guangdong had 65.2%, 17.4%, and 17.4% in the corresponding intervals. These differences were statistically significant ($p<0.001$).

Table2: Work-related information of vaccinators among vaccinators in Primary Healthcare

	Total (n=345)	Respondents Across Four Provinces				
		Liaoning (n=108)	Yunnan (n=70)	Hubei (n=58)	Guangdong (n=109)	P value
Average working time, mean	20.63	14.86	28.49	16.46	16.66	<0.001
Dose injected, mean	3147.17	2120.36	655.24	2132.78	6034.66	<0.001
Period till last training, n (%)						<0.001
Less than 6 months	268 (77.7%)	90 (83.3%)	53 (75.7%)	54 (93.1%)	71 (65.2%)	
6 - 12 months	49(14.2%)	11 (10.2%)	15 (21.4%)	4 (6.9%)	19 (17.4%)	
More than 1 year	28(8.1%)	7 (6.5%)	2 (2.9%)	0.0	19 (17.4%)	

3.1.2 Participants' Knowledge concerning PCV-13

The analysis of participants' knowledge scores revealed an overall average of 5.68 (SD = 0.66), indicating high comprehension among healthcare professionals. By province, Liaoning recorded the lowest mean knowledge score of 5.41 (SD = 0.84), whereas Hubei exhibited the highest at 5.83 (SD = 0.46). Guangdong and Yunnan demonstrated intermediate scores of 5.81 (SD = 0.57) and 5.77 (SD = 0.49), respectively. These variations in mean knowledge scores across different provinces, as depicted in Chart 1.

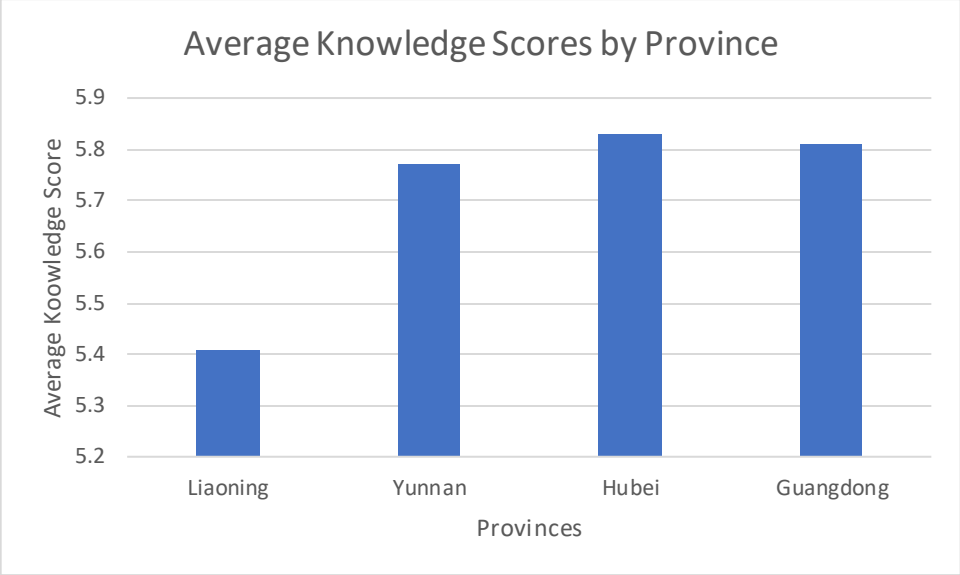

Figure 1. Average Knowledge Scores by Province

3.1.3 Participants' Attitude and Practice Concerning PCV13

The participants' attitudes towards various aspects of their profession are outlined in Table 3.1, which details the responses from a sample of 345 vaccinators across four provinces: Liaoning, Yunnan, Hubei, and Guangdong.

Attitude towards the first question (Q1) regarding personal perception of vaccine safety showed that 22.6% of participants felt very low safety, while 27.5% perceived safety as very high. Liaoning had the highest percentage of respondents who felt very high safety at 76.5%, while Guangdong had the lowest at 4.6%. The differences were not statistically significant (p=0.077).

The second question (Q2) assessed the necessity of vaccines, with 23.77% of total participants considering them absolutely necessary. The provincial responses varied, with Hubei showing the highest agreement at 27.59% and Yunnan the lowest at 18.57%. However, these differences were not statistically significant ($p=0.238$).

For the third question (Q3), which inquired about agreement with vaccine mandates, 22.6% completely disagreed, and 44.35% strongly agreed with such mandates. Here, Liaoning showed the highest agreement at 48.5%, and Yunnan had the highest disagreement at 34.3%. These attitudes did not significantly differ across provinces ($p=0.764$).

Attitude towards the fourth question (Q4) about the promotion of vaccines, 28.7% of participants agreed strongly. Guangdong had the highest percentage of strong agreement at 27.5%, while Yunnan did not have any participants who completely disagreed. Again, the differences were not statistically significant ($p=0.526$).

Regarding the fifth question (Q5), which focused on promoting positive behaviors and knowledge about vaccines, a significant provincial variation was found ($p=0.003$). Liaoning had the highest percentage of respondents who promote positive behaviors at 4.3%, while Hubei had the highest percentage for knowledge and information awareness at 19.0%.

When asked about the influence of patient beliefs and attitudes (Q6), the majority, 65.5%, reported that it did not influence their attitudes, with Hubei having the highest percentage of 'No' responses at 73.1%. The differences across provinces were not significant (p=0.408).

Lastly, when participants were queried about their confidence in discussing vaccine-related information with patients (Q7), 89.2% felt confident. Hubei had the highest confidence level at 100%, and Yunnan had the lowest at 70.0%. This difference was statistically significant (p=0.008).

Table3.1 Participants' Attitude Characteristics

	Total (n=345)	**Responds Across Four Provinces**				
		Liaoning (n=108)	**Yunnan** (n=70)	**Hubei** (n=58)	**Guangdong** (n=109)	**P value**
Attitude Q1, n(%)						0.077
Very low	22(6.4%)	11(10.2%)	6 (8.6%)	0(0.0)	5 (4.6%)	
Relatively low	36(10.5%)	10(9.3%)	10(14.3%)	4(6.9)	12(11.0%)	
Moderate	173(50.1%)	45(41.7%)	36(51.4%)	38(65.5)	54(49.5%)	
Relatively high	94(27.5%)	35(32.4%)	12(17.1%)	14(24.1)	33(30.3%)	
Very high	20(5.8%)	7(6.5%)	6(8.6%)	2 (3.5)	5(4.6%)	
Attitude Q2, n(%)						0.238
Absolutely not necessary	8(2.3%)	3(2.8%)	2(2.9%)	0(0.0%)	3(2.75%)	
not necessary	0	0	0	0	0	
Neutral	23(6.67%)	12(11.11%)	2(2.86%)	3(5.17%)	6(5.5%)	
Necessary	82(23.77%)	17(15.74%)	18(25.71%)	16(27.59%)	31(28.44%)	
Absolutely necessary	232(67.25%)	76(70.37%)	48(68.57%)	39(67.24%)	69(63.30%)	
Attitude Q3, n(%)						0.764
Completely disagree	22(6.38%)	9(8.3%)	3(4.3%)	5(8.6%)	5(4.6%)	
Disagree	17(4.93%)	5(4.6%)	4(5.7%)	4(6.9%)	4(3.7%)	
Neutral	79(22.90%)	27 (25.0%)	16(22.9%)	15(25.9%)	21(19.3%)	
Agree	74(21.5%)	20(18.5%)	20(28.6%)	10(17.3%)	24(22.0%)	
Strongly agree	153(44.4%)	47(43.5%)	27(38.6%)	24(41.4%)	55(50.5%)	
Attitude Q4, n(%)						0.526
Completely	5(1.5%)	2(1.9%)	0(0.0%)	2(3.5%)	1(0.9%)	

disagree						
Disagree	2(0.6%)	1(0.9)	0(0.0%)	0(0.0%)	1(0.9%)	
Neutral	38(11.0%)	14(13.0%)	2(2.9%)	7(12.1%)	15(13.8%)	
Agree	99(28.7%)	28(25.9%)	24(34.3%)	17(29.3%)	30(27.5)	
Strongly agree	201(58.3%)	63(58.3%)	44(62.9%)	32(55.2%)	62(56.9%)	
Attitude Q5, n(%)						0.003
Promo/Rec Behaviors	18 (5.2%)	4 (3.7%)	3 (4.3%)	3 (5.2%)	8 (7.3%)	
Knowledge/Info Awareness	41 (11.9%)	12 (11.1%)	10 (14.3%)	11 (19.0%)	8 (7.3%)	
Vaccine Price	50 (14.5%)	13 (12.0%)	14 (20.0%)	7 (12.1%)	16 (14.7%)	
Patient Beliefs/Attitudes	225 (65.2%)	78 (72.2%)	43 (61.4%)	30 (51.7%)	74 (67.9%)	
Other Factors (Specify)	11 (3.2%)	1 (0.9%)	0	7 (12.0%)	3 (2.8%)	
Attitude Q6, n(%)						0.408
No	23(6.67%)	12(11.1%)	4(5.7%)	2(3.5%)	5(4.6%)	
Yes	277(80.29%)	82(75.9%)	59(84.3%)	47(81.7%)	89(81.7%)	
Not sure	45(13.04%)	14(13.0%)	7(10.0%)	9(15.5%)	15(13.8%)	
Attitude Q7, n(%)						0.008
No	5(1.5%)	4(3.7%)	0(0.0%)	0(0.0%)	1(0.9%)	
Yes	302(87.5%)	89(82.4%)	70(100.0%)	49(84.5%)	94(86.2%)	
Not sure	38(11.0%)	15(13.9%)	0(0.0%)	9(15.5%)	14(12.8%)	

The results from the survey regarding the practices of vaccinators in recommending pneumococcal vaccines are summarized in the table3.2. For the first question on whether they have recommended pneumococcal vaccines to children's guardians in their professional work, 9.9% reported never doing so, 35.7% occasionally recommended vaccines, and the majority, 54.5%, often recommended them.

When it comes to recommending pneumococcal vaccines to friends, family, or relatives, a vast majority (85.8%) stated they had not recommended it, 9.6% recommended, and 4.6% were unsure.

For those who had not recommended the pneumococcal vaccine, the reasons were varied: 44.6% attributed this to a lack of knowledge about the vaccine, 24.6% had

concerns about adverse vaccine reactions, 10.7% doubted the vaccine's efficacy, 13.6% considered it outside their job responsibilities, and 6.4% lacked the initiative to recommend it.

Lastly, regarding the vaccinators' personal practices, 66.5% reported that their children had not received the PCV13 vaccine, while 33.5% had their children vaccinated with PCV13.

Table 3.2 Participants' Practice Characteristics

Practice Q1, n(%)	Have you recommended pneumonia-related vaccines to parents or guardians of infants in your previous work?					<0.001
Never	34(9.9%)	23(21.3%)	3(4.3%)	0(0.0%)	8(7.3%)	
Occasionally	123(35.7%)	42(38.9%)	16(22.9%)	19(32.8%)	46(42.2%)	
Often	188(54.5%)	43(39.8%)	51(72.9%)	39(67.2%)	55(50.5%)	
Practice Q2, n(%)	Have you recommended pneumonia-related vaccines to your friends, family, or relatives?					<0.001
Unsure	16(4.6%)	6(5.6%)	1(1.4%)	2(3.5%)	7(6.4%)	
Not Recommended	296(85.8%)	80(74.1%)	66(94.3%)	53(91.4%)	97(89.0%)	
Recommended	33(9.6%)	22(20.4%)	3(4.3%)	3(5.2%)	5(4.6%)	
Practice Q3, n(%)						<0.001
Lack of knowledge	154(44.6%)	35(32.4%)	48(68.6%)	25(43.1%)	46(42.2%)	
Having concerns	85(24.6%)	23(21.3%)	7(10.0%)	23(39.7%)	32(29.3%)	
Having doubts	37(10.7%)	18(16.7%)	6(8.6%)	3(5.2%)	10(9.2%)	
Don't care	47(13.6%)	17(15.7%)	9(12.9%)	5(8.6%)	16(14.7%)	
Lack of initiative	22(6.4%)	15(13.9%)	0(0.0%)	2(3.5%)	5(4.6%)	
Practice Q4, n(%)	Have your children been vaccinated with the PCV13 vaccine? (Yes/No)					0.687
No	177 (66.5%)	53 (64.6%)	30 (65.2%)	39 (73.6%)	55 (64.7%)	
Yes	89 (33.5%)	29 (35.4%)	16 (34.8%)	14 (26.4%)	30 (35.3%)	

3.1.4 Demographic characteristics of COVID-19 knowledge

The regression analysis revealed statistically significant regional differences in the logarithm of vaccinators' knowledge scores. Specifically, after adjusting for other factors in the model, vaccinators in Yunnan had an average knowledge score that was

approximately 7.34% higher than their counterparts in Liaoning (coefficient = 0.071, P = 0.004). Similarly, those in Hubei exhibited an average increase of 9.32% in knowledge scores compared to Liaoning (coefficient = 0.088, P = 0.001).

For other variables such as age groups, sex, educational level, work experience, income level, and ethnicity, the observed changes in knowledge scores were not statistically significant, suggesting no discernible association with vaccinators' knowledge scores. Notably, an observed but non-significant decrease in knowledge scores was noted for individuals aged above 46, and a slight decrease for males compared to females. Higher educational levels above high school corresponded to higher knowledge scores.

Average working time and the period since the last training did not show a significant effect on the knowledge scores. Lastly, vaccinators in Guangdong displayed an average increase in knowledge scores compared to those in Liaoning, though this increase was not statistically significant (coefficient = 0.048, P = 0.195).

Table 4 Demographic characteristics of COVID-19 knowledge

	Total (n=345)	
	Coefficient (95% CI)	*P* value
Age in groups (ref: 18 - 25)		
26 - 35	-0.001(-0.051,0.049)	0.969
36 - 45	-0.002(-0.077,0.080)	0.967
46 above	-0.062(-0.234,0.071)	0.451
Sex=Male (ref: Female)	-0.008(-0.224,0.100)	0.464
Education level (ref: High school)		
High school above	-0.011(-0.072,0.049)	0.711
College above	-0.023(-0.123,0.076)	0.646
Working experiences (ref: ≤5 years)		
6 years -10 years	-0.003(-0.047,0.041)	0.904
11 years -15 years	0.005(-0.046,0.055)	0.860
≥16 years	-0.006(-0.066,0.055)	0.850
Income level= Above 50,000 (ref: Below 50,000)	0.011(-0.108,0.130)	0.869

Ethnicity= non-Han (ref: Han)	0.037(-0.064,0.139)	0.856
Average working time	-0.000(-0.001,0.001)	0.763
Period till last training (ref: Less than 6 months)		
6 - 12 months	0.022 (-0.014,0.057)	0.227
More than 1 year	-0.032(-0.086,0.022)	0.242
Location (ref: Liaoning)		
Yunnan	0.071 (0.022, 0.120)	0.004
Hubei	0.088 (0.039, 0.137)	0.001
Guangdong	0.048 (-0.025,0.122)	0.195

3.2 Qualitative Analysis Section

3.2.1 Knowledge on Non-NIP Vaccines

The understanding of non-NIP vaccines, particularly the 13-valent pneumococcal conjugate vaccine (PCV13), among healthcare professionals reveals a complex landscape. This analysis highlights their knowledge regarding the origin (imported vs. domestic) of PCV13, its demand, and vaccination coverage among different population groups.

Healthcare workers expressed an understanding of PCV13's balanced demand, irrespective of its origin. One district-level disease control officer from Wuhan mentioned, "the demand for other vaccines, like the 13-valent pneumonia vaccine, whether imported or domestically produced?" indicating a query on vaccine preference (District-level Disease Control, Wuhan).

Discussions with provincial disease prevention centers revealed no precise estimates on the vaccination rates for PCV13, especially among children. "We haven't

estimated... the quantity isn't large" (Provincial Disease Prevention Center), indicating a gap in quantitative data for vaccine uptake.

3.2.2 Attitudes on Non-NIP Vaccines

The attitudes of healthcare workers towards non-NIP vaccines highlight a nuanced perspective influenced by practical experiences, economic considerations, and policy constraints.

Economic and Policy Influences on Vaccine Acceptance

Healthcare workers underscore the significant role of vaccine cost in parental acceptance. The diverse pricing of vaccines, especially pneumococcal vaccines with costs ranging from 400 to over 700, underscores the economic burden on families. One worker noted, "Price is indeed a leading factor... with the 400-plus ones being more common," highlighting the preference for domestically produced, more affordable vaccines (Community Health Service Center Worker, Dalian). This price sensitivity is further complicated by policy limitations, as mentioned by a healthcare worker who observed the difficulty in maintaining vaccination programs under tight budgets (Disease Control Center Worker).

Early Protection and Promotion Challenges

Promotional efforts focus on the notion of early protection, advocating for the inclusion of domestically produced vaccines in free vaccination schemes to enhance their uptake. A healthcare worker expressed, "Early vaccination, early protection... if

policies initially favored domestic vaccines being free, it would promote their use" (Community Health Center Worker, Chengdu). However, navigating policy frameworks and budgetary constraints poses significant challenges in sustaining these efforts.

3.2.3 Practice on Non-NIP Vaccines

The practice of promoting non-NIP vaccines, such as PCV13 and rotavirus vaccines, by vaccinators is significantly shaped by a complex interplay of their own knowledge and attitudes, societal perceptions, and economic considerations. Vaccinators play a pivotal role in health education and the promotion of vaccines, yet face distinct challenges that influence their willingness and approach to recommend these vaccines.

Vaccinators' understanding of the importance and efficacy of non-NIP vaccines is a critical driver in their practice of recommending vaccines. However, a prevailing concern among vaccinators is the fear of being perceived as profiting from the sale of vaccines, particularly those that require out-of-pocket expenses by patients. This concern can hinder their willingness to actively recommend non-NIP vaccines, reflecting a tension between professional duty and the potential for misinterpretation of their motivations.

The public's receptiveness to health education has notably increased post-COVID-19, with a heightened demand for comprehensive vaccine information.

Vaccinators observed that "Post-COVID-19, the public's acceptance of health education is higher... but they also demand more from our health promotion" (Sichuan Disease Control Center). While this shift offers an opportunity to enhance vaccine uptake, vaccinators must navigate the delicate balance of educating without appearing to unduly influence vaccine decisions for personal gain.

The cost of vaccines emerges as a crucial factor influencing both vaccinators' practices and public acceptance. Economic considerations can deter families from opting for non-NIP vaccines, necessitating a careful approach in vaccine promotion. Vaccinators need to address cost concerns transparently, advocating for vaccines based on their public health value while acknowledging the financial burden on families. The development of promotional strategies that underscore vaccine efficacy and safety must also consider the economic implications for the target population.

4. Discussion

This thesis examines the Knowledge, Attitudes, and Practices (KAP) of healthcare providers regarding the 13-valent pneumococcal conjugate vaccine (PCV13), a non-NIP vaccine, across four provinces in China. The mixed-method approach yielded both quantitative and qualitative data, revealing high knowledge levels and a significant discrepancy between professional recommendations and personal practices of vaccinators.

Vaccinators exhibited high knowledge about PCV13, suggesting an awareness of its benefits. However, despite understanding its preventive role, personal application lagged, as evidenced by lower vaccination rates among their own children. This finding echoes the "knowledge-attitude-practice" gap[22] documented in literature, where health professionals recognize the importance of vaccines but fail to translate this into personal practice due to various barriers, ranging from economic constraints to personal beliefs. Echoing the calls for culturally sensitive health interventions, this study emphasizes the necessity of tailoring public health messaging to align with local sociocultural and economic conditions[23].

Comparatively, the study highlighted regional differences in vaccine knowledge, which aligns with prior research indicating geographical disparities in healthcare[24]. Such variability necessitates tailored educational programs that account for local cultural, economic, and infrastructural differences.

The nuanced findings from our study on the KAP of vaccinators regarding non-NIP vaccines lay a critical foundation for future policy-making and research directions. Notably, the practice of recommending vaccines to children's guardians professionally contrasts sharply with personal practices, where a significant portion of vaccinators did not have their children receive the PCV13 vaccine. This divergence suggests a complex interplay of professional duty and personal belief or confidence in the vaccine, underscoring the need for policies that address these discrepancies directly. Strategies could include enhancing transparency about vaccine efficacy and safety, specifically targeting healthcare workers to increase their personal uptake of vaccines, thereby setting a positive example for the community.

Furthermore, the study's revelation of a predominant hesitancy in recommending pneumococcal vaccines to close contacts because of varied reasons - including a significant number attributing their reluctance to a lack of knowledge about the vaccine - signals a pressing requirement for continuous education and training for healthcare providers. It emphasizes the potential impact of equipping healthcare workers with the knowledge and confidence to advocate for vaccinations not only within their professional capacity but also within their social circles.

Furthermore, the study's revelation of a predominant hesitancy among healthcare providers in recommending pneumococcal vaccines to close contacts for varied reasons, notably a significant number attributing their reluctance to a lack of

knowledge about the vaccine, signals a pressing requirement for continuous education and training. This finding is consistent with the observations made by MacDougall et al. [25], who reported that healthcare professionals often cite insufficient knowledge as a barrier to vaccine advocacy. It underscores the importance, as emphasized by the previous study[26], of equipping healthcare workers with adequate information and confidence to advocate for vaccinations. It emphasizes the potential impact of equipping healthcare workers with the knowledge and confidence to advocate for vaccinations not only within their professional capacity but also within their social circles.

The study's limitations, such as the cross-sectional design, potential selection bias, and notably, the small sample size, pinpoint critical areas for improvement in future research. These constraints highlight the need for longitudinal studies to explore changes over time in vaccinators' attitudes and practices, as well as studies with larger and more diverse samples to enhance the generalizability of the findings. Additionally, integrating qualitative methodologies could provide deeper insights into the reasons behind the observed practices and attitudes, offering more targeted data for crafting interventions. Moreover, the sample of vaccinators was exclusively from basic-level health organizations responsible for vaccination, potentially limiting the breadth of perspectives on vaccination practices. This study also did not investigate the relationships between knowledge and attitudes, as well as between attitudes and

practices, because the small sample size yielded non-significant results, thus restricting the ability to fully explore these potentially informative associations.

These findings and subsequent recommendations present a roadmap for nuanced policy adjustments and future research. By delving deeper into the barriers and facilitators of vaccine recommendation and uptake among healthcare professionals, policy makers and researchers can collaboratively develop more effective strategies to enhance public health outcomes through improved vaccination rates.

This study's primary strength lies in its comprehensive evaluation of the KAP of vaccinators across several provinces, shedding light on the intricate dynamics of vaccination advocacy in China. The wide geographical scope and the diverse backgrounds of the participants provide a rich dataset that contributes significantly to the understanding of regional vaccination practices and the factors influencing them.

However, the study's design also introduces limitations that warrant consideration. The relatively small sample size could affect the generalizability of the findings, potentially limiting the study's ability to detect more subtle regional or demographic differences in vaccinators' KAP. Additionally, self-reported measures are susceptible to social desirability bias, which could influence the accuracy of the reported practices and attitudes.

Interpreting the results of this study necessitates consideration of the broader milieu of China's healthcare system, deeply rooted cultural norms, and the socio-

economic landscape. The observed regional discrepancies in vaccine knowledge and attitudes underscore an urgent need for health communication strategies tailored to the distinct needs and values of local populations. To effect meaningful change, practical applications of these findings suggest a pivot in vaccination advocacy strategies. There is a call for educational programs that are more sophisticated and culturally congruent, potentially incorporating narratives and testimonials from healthcare providers with firsthand experience with PCV13. In conjunction with these educational efforts, policy-makers might consider subsidization of non-NIP vaccines as a means to alleviate economic hurdles to vaccine uptake[10 27].

From a theoretical standpoint, the research enriches the body of knowledge on health behavior theory, especially in relation to preventive healthcare practices amongst health professionals. It reveals the complexities involved in changing health behaviors, even among those with the knowledge to make informed health decisions. Extending beyond the scope of this study, the implications for public health strategy in emerging economies with diverse demographics are significant. Aligning the personal behaviors of vaccinators with their professional counsel is critical not just for the integrity of public health campaigns but also for their efficacy[28]. Such alignment has the potential to markedly improve health outcomes across the population, particularly in combating diseases like pneumonia among vulnerable pediatric demographics.

In sum, the insights gleaned from examining the KAP towards PCV13 highlight an essential need for targeted interventions that effectively address the multifaceted dynamics affecting vaccine uptake. The aim is to foster congruence between the knowledge, attitudes, and practices of healthcare professionals to ensure that their personal behaviors reflect the public health advisories they issue. Achieving this congruence is pivotal for the credibility of healthcare workers as vaccination advocates and for the efficacy of public health initiatives. Consequently, further research to design, implement, and assess the impact of interventions that close the gap between knowledge and practice is critical. Such endeavors are paramount not only for healthcare providers but for the broader community they serve, ultimately steering us toward heightened vaccination rates, a reduction in vaccine-preventable illnesses, and a healthier future for all.

5. Conclusion

Strengthening the capacity of vaccinators through education, policy support, and community engagement is essential for advancing public health outcomes and mitigating the impact of vaccine-preventable diseases. This study underscores the critical role of vaccinators in the promotion and administration of non-NIP vaccines, such as PCV13, within China's diverse provincial contexts. Our findings reveal a high level of knowledge among vaccinators concerning PCV13, alongside positive attitudes towards its efficacy and necessity. However, challenges in practice were identified, primarily influenced by economic considerations, policy constraints, and public perception, particularly concerns about vaccinators profiting from vaccine sales. The hesitancy among vaccinators to recommend non-NIP vaccines due to fears of being perceived as profiting emphasizes the need for transparent communication strategies and policy support to mitigate these concerns. The variations in knowledge, attitudes, and practices across the provinces highlight the importance of region-specific strategies to enhance vaccine uptake. Additionally, the study indicates a significant gap between professional advocacy and personal vaccine uptake among vaccinators, suggesting potential areas for intervention to align these aspects more closely. Implications of this study extend to the need for targeted educational interventions to address knowledge gaps among vaccinators, policy adjustments to alleviate economic burdens on families, and efforts to improve public perception and trust in vaccinators' recommendations.

Further research is recommended to explore longitudinal changes in vaccinators' KAP and to assess the impact of intervention strategies on improving vaccine uptake.

Appendix A

I. Basic Information

1. What is your gender? (Male/Female)
2. Please select your age group:
    a) Below 18 years
    b) 18-25 years
    c) 26-35 years
    d) 36-45 years
    e) 46-55 years
    f) Over 56 years
3. What is your province, city, and county? __ Province __ City __ County
4. Your educational background:
    a) High school/Technical secondary school
    b) Junior college
    c) Bachelor's degree
    d) Graduate degree or above
5. Do you have children?
    A. Yes, I have children (please continue to answer question 3.4)
    B. No, I don’t have children
6. How long have you been in your profession?

a) ≤5 years

b) 6-10 years

c) 11-15 years

d) ≥16 years

7. How many years have you worked since graduation?

a) ≤5 years

b) 6-10 years

c) 11-15 years

d) ≥16 years

8. What is your current annual income range?

A. Below 50,000

B. 50,000-100,000

C. 100,000-150,000

D. 150,000-200,000

E. Above 200,000

9. Ethnicity: _____ ethnicity

10. Service time for Category II vaccines: Average working hours per week: _____ hours

11. Approximately how many doses of Category II vaccines have you administered to your service recipients in the past year? _____ doses

12. Last training time:

    A. Less than 6 months ago

    B. 6-12 months ago

    C. More than a year ago

II. Knowledge on PCV13

1. Community-Acquired Pneumonia (CAP) refers to pneumonia acquired in the community setting, not limited to children but also occurring in adults. Do children under 7 years old bear the highest disease burden? (Correct/Incorrect) Incorrect
2. The PCV13 vaccine is a pneumococcal conjugate vaccine that can effectively prevent pneumonia. CAP is commonly found in children aged 0 to 3 years, especially prone to the disease during the winter and spring seasons. (Correct/Incorrect) Correct
3. Pneumonia can lead to a mortality rate of up to 28% in children under 5 years old, making it the second leading cause of death in this age group. (Correct/Incorrect) Correct
4. The PCV13 vaccine is one of the key vaccines for the clinical prevention of pneumonia, capable of preventing pneumonia caused by Streptococcus pneumoniae. (Correct/Incorrect)
5. Which of the following is a payment method for the 13-valent pneumococcal vaccine? (Paid by medical insurance/Self-payment/Government subsidy)

6. Which of the following do you think is the correct timing and interval for PCV13 vaccine administration?

   A. One injection per month for a total of four injections

   B. One injection at the second, fourth, and sixth month after the child's birth, followed by a final injection between 1 to 1.5 years of age

   C. Only one injection is needed, with no further doses required

   D. Injections are given according to the doctor's advice, with no fixed timing and interval.

III. Attitudes on PCV13

1. What do you think about the current level of PCV13 vaccine coverage?

   A. Very low

   B. Somewhat low

   C. Moderate

   D. Somewhat high

   E. Very high

2. Do you think it is necessary to get the PCV13 vaccine?

3. ① Completely unnecessary ② Unnecessary ③ Neutral ④ Necessary ⑤ Absolutely necessary

4. I believe that children can still contract pneumonia even after being vaccinated against influenza.

5. ① Strongly disagree ② Disagree ③ Neutral ④ Agree ⑤ Strongly agree

6. I feel it is my responsibility to promote the 13-valent pneumococcal vaccine.

7. ① Strongly disagree ② Disagree ③ Neutral ④ Agree ⑤ Strongly agree

8. What factors do you think influence patients' willingness to receive the 13-valent pneumococcal vaccine? (Multiple choice)

    a. Promotion and recommendation

    b. Level of knowledge and information

    c. Vaccine cost

    d. Patient's personal beliefs and attitudes

    e. Other factors (please specify)

9. Do you think the cost issue will affect the prevalence of the 13-valent pneumococcal vaccine in the market? (Yes/No/Not sure)

10. If the price is reduced, do you plan to recommend pneumococcal vaccination to your service recipients? (Yes/No/Not sure)

IV. Practices on PCV13

1. Have you recommended pneumonia-related vaccines to parents or guardians of infants in your previous work?

    A. Never

    B. Occasionally

    C. Often

2. Have you recommended pneumonia-related vaccines to your friends, family, or relatives?

    A. Recommended 1

    B. Not recommended 0

    C. Unsure 0

3. If you have not recommended pneumococcal vaccination, what are the reasons? (Multiple choice)

    A. Lack of knowledge about the vaccine

    B. Concern about adverse reactions to the vaccine

    C. Doubts about the vaccine's effectiveness

    D. Not within my job responsibilities

    E. Lack of initiative to recommend

4. Have your children been vaccinated with the PCV13 vaccine? (Yes/No)

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