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Vaccine hesitancy and concerns about vaccine safety and effectiveness in Shanghai, China

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Abstract

Background: Rapidly urbanizing communities in middle income countries could be sources of vaccine hesitancy, and could create hot spots of low vaccination coverage. This study characterizes vaccine hesitancy in Shanghai and identifies disparities in vaccine safety and efficacy concerns by residency status – a marker for recent migration into the city.

Methods: Parents of children ≤18 years old from immunization clinics in Shanghai were enrolled in summer 2019, with the data analyzed during winter 2019–2020. The paper questionnaire used the Parental Attitudes towards Childhood Vaccines (PACV) scale, which included questions about vaccine safety and efficacy concerns. The primary independent variable was residency – whether an individual was a Shanghai local or a recent migrant (i.e. non-local). Linear regression models assessed the relationship between residency and vaccine safety and efficacy concerns.

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Results: Among 1,021 participants, two-thirds (65.4%) had local residency, and the remainder were urban non-locals (13.1%) or rural non-locals (21.5%). A majority of parents expressed concerns about vaccine side effects (73.8%), vaccine safety (63.9%), and vaccine effectiveness (52.4%). Compared to locals, rural non-locals were more concerned about vaccine side effects (β: 0.26, 95% CI: 0.07, 0.46), vaccine safety (β: 0.42, 95% CI: 0.19, 0.65), and vaccine effectiveness (β: 0.37, 95% CI: 0.16, 0.58).

Conclusion: Differences in vaccine hesitancy by residency could lead to geographical and sociodemographic disparities in vaccination coverage and outbreaks of vaccine-preventable disease.

Keywords

China; vaccine-preventable diseases; attitude; vaccines; transients and migrants; urbanization

INTRODUCTION

Although vaccination is a cost-effective strategy for reducing morbidity and mortality from many infectious diseases,[1,2] countries face problems in financing vaccination programs,[3,4] equitably distributing vaccines on time,[5] and maintaining high demand for the vaccines.[6]

It is particularly important to sustain high vaccination coverage among domestic migrants – individuals moving within a country and particularly from rural to urban areas.[7] Because of their increased mobility, migrants may be more likely to be reservoirs of disease.[8] Migrants may have a different socioeconomic background than locals, they may have different experiences with disease, and they may have had less access to health services in their location of origin. Migrants also may be part of a growing middle class that is increasingly obtaining health information online rather than from traditional sources such as their primary care doctor or other medical authority.[9]

As an upper middle-income country,[10] China faces unique challenges in promoting vaccines and maintaining high vaccination coverage. It has the world's second largest annual birth cohort of 14.65 million babies,[11] and has the single greatest contemporary internal population migration underway of any country globally. Between 2008 and 2018, the population living in urban areas increased from 624 million to 831 million.[12] This migration involves non-locals or migrants, also referred to as the floating population in some contexts, moving into cities from poorer, rural, more agrarian areas, although there are also individuals moving between urban areas in the country. In China, many social services and government entitlement programs are limited to individuals with local residency only, but immunizations are provided to Chinese citizens without regard to their residency.[13] China has a robust publicly-funded immunization system which has maintained high vaccination coverage, especially in cities, and even among the non-local population.[14] Although there are some differences across provinces, China provides most pediatric vaccines that are recommended by the World Health Organization[15] for free to citizens. These vaccines are mandatory for school entry. For example, by 6 months, children in Shanghai will have received 3 doses of hepatitis B vaccine, 1 dose of bacillus Calmette-Guérin, 3 doses of inactivated or oral polio vaccine, 3 doses of diphtheria-tetanus-acellular pertussis vaccine,

and one dose of meningococcal polysaccharide vaccine.[16] However, non-locals are less likely to be willing to receive certain vaccines,[17] and their knowledge about vaccines and health literacy are relatively low.[18] How vaccine hesitancy and concerns about vaccines vary between locals and non-locals is less well known.

Chinese parents have also increasingly voiced serious concerns about vaccination. Vaccine hesitancy is a global phenomenon, defined as the "delay in acceptance or refusal of vaccines despite the availability of vaccination services."[19] Vaccine concerns in China include the growing number received at one time, vaccine administration at young ages, and perceived effectiveness and safety.[9,16] Concerns about vaccine quality, safety, and effectiveness are present throughout the world. In one study of individuals from multiple low- and middle-income countries, perceived vaccine safety and effectiveness were the two most important contributors to the intention to receive an influenza vaccine.[20] China overall has a robust infrastructure for surveilling adverse events following immunization.[21] Notably, several vaccine safety or quality events related to vaccine production, procurement, and transportation in China, such as the distribution of expired vaccines or saline products instead of vaccines,[22] have received widespread media attention.

It is important to consider whether there are demographic groups which have more positive or more negative attitudes towards vaccination. Understanding demographic differences in vaccine concerns can highlight the existence of geographic areas with low vaccination coverage and greater risk for outbreaks of vaccine-preventable diseases.[23] Moreover, this information can inform targeted health communications. This study's aims are to characterize vaccine hesitancy in Shanghai with a focus on concerns about vaccine safety and efficacy, and to identify disparities in vaccine hesitancy by residency status and other sociodemographic groups.

METHODS

The data were collected in Shanghai, China, between May and July 2019. The study was analyzed between November 2019 and March 2020.

Study population

This study used a two-stage selection procedure. We randomly sampled forty townships based on the size of their population according to the 2010 Census. All districts in Shanghai were included except Chongming, a less-populated island district relatively far away from the city center. Within each township, parents at immunization clinics were one sampling frame. The immunization clinic typically services children <5 years, and mostly under <2 years given the immunization schedule. To increase enrollment of parents of older children, an elementary school, middle school, and/or high school was selected at 25 townships. These immunization clinics and schools were the locations for a convenience sample of parents. The eligibility criterion was having a child ≤18 years old. Parents with more than one child could be included as long as one of the children was ≤18 years old.

Questionnaire and derived variables

The questionnaire was in simplified Chinese (Mandarin). Participants responded to written questions about their sociodemographic background, including age, sex, educational history, monthly family income, and child's age. Participants provided information about their residency and urbanicity. Residency refers to the family's registered location, which we split into three categories: Shanghai locals, non-locals from other urban areas, and non-locals from rural areas. Urbanicity refers to where the family is actually living whether the urban core of Shanghai or suburban districts.

Parents also answered a question about if a child of theirs had ever had an adverse reaction, and they could respond "yes" or "no" based on self-report.

Outcome

The main outcome of vaccine hesitancy in this study came from the 15-item Parental Attitudes towards Childhood Vaccines (PACV) scale.[24] The original English scale was translated into Mandarin Chinese and back translated to English. In the original survey which was tested in the US, the scale was divided into three domains: general attitudes, safety and efficacy, and vaccination behaviors. The questions that are part of each scale, and their Chinese translations, are in Supplementary Table 1. There were several different types of responses across the questions.[24] In the original scale used in the US,[24] the response scale simplifies into three categories: a point value of 0 referred to those responses most confident and least hesitant about vaccines, and 2 for those responses associated with the most hesitancy about vaccines. A score of 1 was for intermediate responses. In the original formulation of the scale in the US, items within a domain were summed and the sum dichotomized into those hesitant or not (Supplementary Table 2).

An exploratory factor analysis (EFA) characterized the relationships among items in the sample from Shanghai (Supplementary Table 3), and to identify if the factors/domains were the same as the original US scale. Two possible domains largely but not entirely mapped to the original scale's domains "general attitudes" and "safety and efficacy." The relationship between the US and Shanghai domains are in Supplementary Table 3.

The analysis presented in this study focuses on three of the four items within the outcome of "safety and efficacy." The three questions are: v11 "How concerned are you that your child might have a serious side effect from a shot?", v12 "How concerned are you that any one of the childhood shots might not be safe?", and v13 "How concerned are you that a shot might not prevent the disease?" The fourth item, v10 "It is better for children to get fewer vaccines at the same time" did not strongly map onto the same factor in the Shanghai study. All three items' responses were on a 5-point Likert scale from "not at all concerned" to "very concerned." Individuals who were somewhat or very concerned, i.e., who were "hesitant" in the original coding scheme, were described as expressing concern about side effects, safety, or vaccine effectiveness, respectively.

Statistical analysis

The descriptive analyses includes the proportion of individuals who were hesitant in each of the items of the PACV scale overall and by residency group. The significance in differences across residency group comes from the Rao-Scott Chi-square test. The p-values were adjusted for multiple (15) tests through the Holm-Bonferroni method.

A multivariable analysis assessed the relationship between sociodemographic characteristics and more safety and effectiveness concerns, with three separate models for each item. The confounders were added into the model based on *a priori* considerations from past literature using the PACV.[25,26] Past literature has adjusted for parental age, education, income, education, and number of children.[25,26] The original 5-point Likert scale was the outcome in a linear regression model,[27] after the model was evaluated for normality of residuals and homoscedasticity.

To explore whether the slope of the relationship between independent variables and the three items differed, a new dataset was created with three observations per person, with each observation's outcome being a different item. In this model, an interaction term specifying the original item and each independent variable assessed significance of the slope differences.[28]

All analyses included weights based on the sampling scheme. Clustering was based on township and the sampling frame (school vs clinic). All analyses were conducted in SAS version 9.4 (SAS Institute, Cary, NC).

To enable comparisons to other research using the original PACV scales, findings using the original PACV scale and subdomains are in Supplementary Tables 2 and 4.

Ethical approval

The study was approved by the Health Sciences and Behavioral Sciences Institutional Review Board at the University of Michigan (#HUM00155864) and the Shanghai Center for Disease Control and Prevention Ethical Review Committee (#2019–17). Parents selected at an immunization clinic or school were given an informed consent form. Parents provided signed informed consent prior to starting the paper questionnaire.

RESULTS

A total of 1,183 individuals in Shanghai were approached to participate in the survey. Of these 66 refused to participate and 76 started but did not complete the survey, yielding a final sample size of 1,041 (88.0%). Subsequently, we excluded 20 grandparents who had been included, leading to a final sample size of 1,021.

The distribution of the sample's demographic characteristics is shown in Table 1. About two-thirds (65.4%) had local residency, and the rest were urban non-locals (13.1%) or rural non-locals (21.5%). Less than one-third (29.8%) of the sample lived in urban districts, with the rest in suburbs. The population as a whole had high levels of education: about half of respondents (48.2%) had a bachelor's degree or a graduate degree (4.5%). Less than one-

fourth only had a high school education (12.3%) or less (12.2%). Most parents indicated that their child had not experienced an adverse reaction following vaccination. (89.1%). Several characteristics varied by urbanicity: compared to locals, rural non-locals had larger families (P=0.0024), spent less time in Shanghai (P<0.0001), had lower monthly income and lower levels of education (both P<0.0001), and were younger parents (P<0.0001)

Responses to the individual items that make up the PACV scale are shown in Table 2. In total, 42.5% of the sample mentioned delaying a vaccine and 11.5% mentioned not getting a vaccine for reasons other than illness or allergy. A majority of parents expressed concerns about vaccine side effects (73.8%), vaccine safety (63.9%), and vaccine effectiveness (52.4%). Other questions with commonly expressed hesitant views above 20% included parents delaying vaccination (42.5%), preferring child to not be co-administered multiple vaccines (42.0%), concerns about the number of shots (31.7%), and an overall rating of vaccine hesitancy (20.8% identified as hesitant).

Some item responses varied by residency (Table 2). Rural non-locals were more likely to believe that not following the recommended schedule was a good idea (34.1%) compared to urban non-locals (11.2%) or locals (14.1%) (P=0.0003). Rural non-locals were also more concerned about side effects (86.7%, P=0.0495) and that the vaccine might not prevent disease (62.9%, P=0.0250) compared to their counterparts (among locals 71.0% and 49.3%, respectively).

The multivariable models focused on vaccine safety and efficacy concerns (Table 3). Compared to locals, rural non-locals were more concerned about vaccine side effects (β: 0.26, 95% CI: 0.07, 0.46), vaccine safety (β: 0.42, 95% CI: 0.19, 0.65), and vaccine effectiveness (β: 0.37, 95% CI: 0.16, 0.58). The intercept was significantly different across the three models (P=0.0047), indicating that there were more concerns about side effects (β: 3.81) then vaccine effectiveness (β: 3.26), but otherwise there were no differences in the slopes of each model.

DISCUSSION

Rapid urbanization in China and other middle-income countries has created a group of migrants whose experiences and backgrounds are different from locals and may differentially impact their confidence in vaccines and their vaccine uptake. In this cross-sectional study of vaccine hesitancy in Shanghai, China, parents expressed hesitancy largely in terms of perceived vaccine safety and efficacy, and with regard to the expanding schedule of recommended vaccines. Generally, those holding a non-local (vs local) residency were found to be more hesitant which could potentiate spatial clustering of under-vaccinated children and lead to greater vaccination heterogeneity within the city. Vaccine hesitancy results from individual/group, vaccine-specific, and contextual influences.[29,30] This study examines one dimension of contextual influence (residency status), and individual influences, i.e., perceived risks and benefits of vaccination.[31]

Previous studies have also investigated differences in vaccination status and attitudes by residency in China. Uptake of routinely provided, free immunizations is relatively high

across residency groups,[32] although there are more differences in coverage of vaccines that require payment.[14] Even though currently there are not large observed differences in vaccine coverage, studies have shown differences in vaccine attitudes. A previous study using the World Health Organization (WHO) Strategic Advisory Group of Experts on Immunization (SAGE) Vaccine Hesitancy Scale found that rural non-locals also had less confidence in vaccines than locals.[33]

There are several possible reasons that residency may relate to vaccine hesitancy. Individuals in this study came from three different categories: locals, urban non-locals, and rural non-locals. Rural non-locals were the most socioeconomically disadvantaged group, with the lowest income and educational attainment. Urban non-locals, on the other hand, were as a whole more socioeconomically advantaged than locals. These differences in this study probably speak to reasons for migration. Non-locals in China predominantly move into new regions for economic opportunities.[34] Past research has also shown a U-shaped relationship between economic livelihood and likelihood of migration, in that the individuals who migrate into new areas are among the poorest or the wealthiest in their original hometown.[35] In summary, these differences between non-local groups speak to the need for health care workers and vaccination providers to understand the background of their patient families and realize that migrants from rural areas may have more concerns about vaccinations, which could translate hesitancy into following the recommended vaccination schedule. Without addressing these issues, there could be substantial spatial patterning of vaccination uptake that results from these beliefs, particularly as non-locals cluster together. According to the 2019 Shanghai Statistical Yearbook, non-locals mainly cluster in some suburban districts.[36]

This study has found that an overwhelming concern of local and non-locals parents is related to vaccine safety. Other studies have also echoed this point. A study of mothers in four low- and middle-income countries found that perceived vaccine safety was one of the most important factors related to intent to vaccinate their child against influenza.[20] Another set of surveys in different low- and middle-income countries found that concerns about adverse events after pediatric immunizations were common in mothers.[37] Moreover, beliefs about vaccine safety were strongly associated with intent to receive a seasonal influenza vaccine in Hong Kong,[38] and human papillomavirus vaccines in a systematic review[39]. Vaccine hesitancy is prominent in other east Asian countries. For example, studies in South Korea[40] and Japan[41] have revealed substantial concerns about vaccine safety.

Perceptions of safety and effectiveness were linked in this study. Improving perceptions of vaccine safety could also influence other beliefs regardless of residency status. Many people hold to an affect heuristic in which they believe that medical interventions that are more effective are less risky, and if they believe an intervention is not very effective, they will also think it to be relatively risky.[42,43] This explains how perceived vaccine safety and efficacy are inextricably linked. Interventions that effectively target beliefs about vaccine effectiveness, can also impact beliefs about vaccine safety and vice versa.

Past research has shown that successful interventions employ multiple strategies.[44] For example, individual/group targets would include increasing knowledge of vaccines and enhancing social norms of immunizations. Vaccine-specific issues, like increasing

convenience of access to clinics, and contextual issues, like mandating vaccines or engaging influential leaders are other settings for addressing vaccine hesitancy. Past research has shown that rural non-locals in China have a relatively high amount of trust in government authorities,[45] but individuals from rural areas use health services less often,[46] probably as a result of lower income, different insurance coverage, and inconvenient service hours. Because the government provides many routinely administered pediatric immunizations to children regardless of their residency, vaccine promotions in rural populations could positively focus on the role of the government. It also is important to consider China-specific issues, including recent scandals on vaccine quality[47] and decreased trust in the government in some sectors.[48]

Vaccine concerns may change in the future depending on which vaccines are added to the routine immunization schedule. People's perception of the threat of a disease could relate to their knowledge of the disease and could influence vaccine hesitancy, in turn. Chinese companies have developed vaccines for diseases of local epidemiological importance, such as hepatitis E[49,50] and hand, food, and mouth disease[51]. These vaccines may be more relevant to non-locals who may be at higher risk because they more frequently travel and visit rural areas. Currently, in Shanghai, these vaccines are not freely provided, and increased vaccine hesitancy in rural non-locals could limit their uptake in this high risk group. There could be lower coverage in rural non-locals because of cost of the vaccines, and greater concerns over vaccine safety and effectiveness in general.

Strengths and limitations

This study used a sample of parents from nearly all districts of Shanghai, and included parents of diverse age ranges, and whose children varied in age. However, there are limitations. This study includes a convenience sample from immunization clinics and schools, meaning that the sample may be biased towards individuals who are more health conscious and of higher socioeconomic status. The inclusion of schools could have limited participation of non-locals, and is shown in fewer non-locals having older children. Nine years of schooling is mandatory in China, but non-locals often send their children to school in their home province because of regulatory difficulties in Shanghai.[52] As a cross-sectional study, we were unable to assess the relationship between vaccine hesitancy and actual vaccination uptake, but plan to collect this information in future studies.

Conclusions

Maintaining community demand for vaccination is a key component of disease control efforts, especially in low- and middle-income countries where the burden of vaccine preventable diseases has historically been greater.[6] However, as the rates of infectious and vaccine-preventable disease fall in these countries, as they have in China,[53,54] perceptions of vaccination necessity become increasingly decoupled from the actual experience of disease.[6]

In this sample of parents in Shanghai, we found that there was substantial concerns about vaccine safety and efficacy, and that these concerns were greater in some demographic groups, notably among certain non-locals who originally came from rural areas. Differences in vaccine hesitancy by residency could lead to geographical disparities in vaccination

coverage and a greater risk for outbreaks of vaccine-preventable disease. Health education, focused on vaccine safety and efficacy, could be targeted to certain groups with more hesitancy, like non-locals and people living in suburban areas.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Demographic characteristics of individuals by residency status.

	Overall count (col. %)	Locals	Urban non-locals	Rural non-locals	P-value[a]
OVERALL	1021 (100%)	700	130	189	
Number of children					0.0024
1	702 (65.0%)	559 (71.7%)	68 (63.2%)	75 (46.1%)	
≥2	319 (35.0%)	141 (28.3%)	62 (36.9%)	114 (53.9%)	
Age of oldest child					<0.0001
0–3 years	114 (15.4%)	57 (11.7%)	27 (17.9%)	30 (25.5%)	
4–6 years	148 (22.8%)	81 (18.8%)	27 (22.9%)	40 (35.3%)	
7–12 years	364 (33.2%)	243 (33.9%)	47 (39.3%)	72 (27.1%)	
13–18 years	350 (25.8%)	297 (33.2%)	20 (15.6%)	33 (9.5%)	
≥19 years	38 (2.7%)	18 (2.4%)	8 (4.3%)	12 (2.5%)	
Relationship to child					1.00
Mother	818 (83.1%)	576 (84.6%)	104 (82.7%)	136 (79.0%)	
Father	203 (16.9%)	124 (15.4%)	26 (17.3%)	53 (21.1%)	
Length of time in Shanghai					<0.0001
0–5 years	50 (7.2%)	3 (0.2%)	12 (4.6%)	35 (29.8%)	
6–10 years	114 (14.2%)	24 (5.5%)	38 (33.4%)	52 (29.1%)	
≥11 years	230 (22.2%)	107 (15.6%)	57 (45.1%)	66 (28.4%)	
Entire life	613 (56.5%)	557 (78.6%)	21 (16.9%)	33 (12.8%)	
Urbanicity					1.00
Urban	202 (29.8%)	158 (32.9%)	14 (23.8%)	30 (24.0%)	
Suburban	819 (70.2%)	542 (67.1%)	116 (76.2%)	159 (76.0%)	
Monthly income					<0.0001
<10,000 RMB	334 (32.8%)	215 (29.2%)	21 (12.2%)	98 (56.2%)	
10,000 to 19,999 RMB	389 (37.5%)	280 (40.4%)	49 (43.7%)	60 (24.9%)	
≥20,000 RMB	293 (29.7%)	202 (30.4%)	60 (44.1%)	31 (18.9%)	
Education					<0.0001

	Overall count (col. %)	Locals	Urban non-locals	Rural non-locals	P-value[a]
<High school	129 (12.2%)	51 (8.3%)	11 (5.2%)	67 (28.3%)	
High school	136 (12.3%)	67 (6.2%)	16 (12.1%)	53 (31.3%)	
Vocational school	248 (22.8%)	182 (25.9%)	26 (14.1%)	39 (18.6%)	
Bachelor's degree	445 (48.2%)	354 (54.3%)	64 (61.7%)	26 (21.5%)	
Graduate degree	48 (4.5%)	36 (5.3%)	11 (7.0%)	1 (0.4%)	
Age					<0.0001
20–29 years	71 (11.0%)	26 (4.1%)	6 (5.5%)	39 (35.4%)	
30–39 years	589 (62.4%)	376 (62.2%)	94 (70.0%)	117 (58.3%)	
40–49 years	324 (24.7%)	271 (31.4%)	27 (23.7%)	26 (4.9%)	
≥50 years	21 (1.9%)	16 (2.3%)	1 (0.8%)	4 (1.4%)	
Child has experienced adverse reaction					1.00
No	895 (89.1%)	608 (89.6%)	114 (85.6%)	173 (89.8%)	
Yes	122 (10.9%)	90 (10.5%)	16 (14.4%)	16 (10.2%)	

Notes

[a]From Rao-Scott Chi-square test, with a Holm-Bonferroni correction for multiple testing

Table 2.

Vaccine hesitancy domains by residency status

	English question	In total population			Among locals	Among non-local urban	Among non-local rural	
		% not hesitant	% undecided	% hesitant	% hesitant	% hesitant	% hesitant	P-value[a]
General attitudes subdomain								
v3	How sure are you that following the recommended shot schedule is a good idea for your child?	74.6%	7.4%	18.0%	14.1%	11.2%	34.1%	0.0003
v5	If you had another infant today would you want him/her to get all the recommended shots?	54.3%	30.1%	15.7%	15.4%	17.9%	15.0%	1
v6	Overall how hesitant about childhood shots would you consider yourself to be?	69.8%	9.5%	20.8%	20.0%	25.0%	20.7%	1
v7	Children get more shots than are good for them.	24.4%	43.9%	31.7%	30.5%	35.0%	33.1%	1
v8	I believe that many of the illnesses shots prevent are severe.	72.3%	23.4%	4.3%	5.4%	4.2%	1.0%	1
v9	It is better for my child to develop immunity by getting sick than to get a shot.	59.0%	29.4%	11.6%	13.4%	4.5%	10.5%	0.0728
v16	I trust the information I receive about shots.	65.7%	31.1%	3.2%	1.7%	2.2%	8.5%	0.6704
v17	I am able to openly discuss my concerns about shots with my child's doctor.	77.6%	18.8%	3.6%	3.6%	3.3%	3.8%	1
v18	All things considered how much do you trust your child's doctor?	72.7%	10.7%	16.6%	14.0%	11.8%	27.6%	0.4998
Safety and efficacy subdomain								
v10	It is better for children to get fewer vaccines at the same time.	36.1%	42.0%	22.0%	26.1%	16.3%	13.2%	0.2964
v11	How concerned are you that your child might have a serious side effect from a shot?	19.4%	6.8%	73.8%	71.0%	66.6%	86.7%	0.0495
v12	How concerned are you that any one of the childhood shots might not be safe?	25.6%	10.5%	63.9%	60.2%	62.8%	75.9%	1
v13	How concerned are you that a shot might not prevent the disease?	27.6%	20.0%	52.4%	49.3%	50.5%	62.9%	0.0250
Vaccination behaviors subdomain								
v1	Have you ever delayed having your child get a shot for reasons other than illness or allergy?	54.9%	2.7%	42.5%	39.1%	36.2%	56.6%	0.1340

	English question	In total population			Among locals	Among non-local urban	Among non-local rural	
		% not hesitant	% undecided	% hesitant	% hesitant	% hesitant	% hesitant	P-value[a]
v2	Have you ever decided not to have your child get a shot for reasons other than illness or allergy?	83.3%	5.3%	11.5%	12.6%	11.5%	8.0%	0.9846

Notes

[a]From Rao-Scott Chi-square test, with a Holm-Bonferroni correction for multiple testing

Table 3.

Multivariable table predictors of concerns about safety and efficacy using the Parental Attitudes about Childhood Vaccines (PACV) (n=987).

	Concerns about side effects β (95% CI)	Concerns about safety β (95% CI)	Concerns about effectiveness β (95% CI)	P[a]
Intercept	3.81 (3.51, 4.11)	3.66 (3.28, 4.04)	3.26 (2.80, 3.73)	0.0047
Number of children				0.9199
1	ref	ref	ref	
≥2	0.21 (−0.03, 0.45)	0.16 (−0.02, 0.35)	0.18 (0.00, 0.36)	
Age of oldest child				0.8195
0–3 years	ref	ref	ref	
4–6 years	−0.05 (−0.40, 0.30)	−0.24 (−0.54, 0.07)	−0.08 (−0.44, 0.28)	
7–12 years	−0.18 (−0.50, 0.15)	−0.20 (−0.68, 0.27)	−0.23 (−0.67, 0.20)	
13–18 years	−0.21 (−0.66, 0.24)	−0.31 (−0.85, 0.24)	−0.29 (−0.83, 0.24)	
≥19 years	−0.43 (−1.12, 0.26)	−0.33 (−1.00, 0.35)	−0.39 (−1.09, 0.30)	
Relationship to child				0.9017
Mother	ref	ref	ref	
Father	0.07 (−0.15, 0.30)	0.07 (−0.14, 0.28)	0.03 (−0.26, 0.32)	
Residency				0.3103
Local	ref	ref	ref	
Non-local urban	−0.10 (−0.47, 0.28)	0.07 (−0.25, 0.39)	−0.23 (−0.52, 0.07)	
Non-local rural	0.26 (0.07, 0.46)	0.42 (0.19, 0.65)	0.37 (0.16, 0.58)	
Urbanicity				0.1104
Urban	ref	ref	ref	
Suburban	−0.04 (−0.28, 0.21)	−0.01 (−0.27, 0.25)	0.17 (−0.11, 0.44)	
Monthly income				0.7518
<10,000 RMB	−0.02 (−0.20, 0.17)	−0.11 (−0.35, 0.12)	−0.15 (−0.42, 0.12)	
10,000 to 19,999 RMB	ref	ref	ref	
≥20,000 RMB	−0.07 (−0.25, 0.12)	−0.11 (−0.41, 0.18)	−0.05 (−0.29, 0.20)	
Education				0.2024
<High school	−0.07 (−0.38, 0.23)	−0.42 (−0.78, −0.05)	−0.06 (−0.38, 0.26)	

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	Concerns about side effects β (95% CI)	Concerns about safety β (95% CI)	Concerns about effectiveness β (95% CI)	P[a]
High school	ref	ref	ref	
Vocational school	0.06 (−0.21, 0.33)	−0.15 (−0.43, 0.13)	−0.09 (−0.40, 0.22)	
Bachelor's degree	−0.01 (−0.25, 0.23)	−0.06 (−0.34, 0.23)	−0.08 (−0.36, 0.20)	
Graduate degree	−0.13 (−0.56, 0.30)	−0.08 (−0.54, 0.39)	0.07 (−0.39, 0.53)	
Age				0.5414
20–29 years	ref	ref	ref	
30–39 years	−0.15 (−0.50, 0.21)	0.07 (−0.24, 0.38)	0.13 (−0.09, 0.35)	
≥40 years	0.00 (−0.42, 0.43)	0.04 (−0.35, 0.43)	0.12 (−0.22, 0.45)	
Child has experienced adverse reaction				0.8382
No	ref	ref	ref	
Yes	−0.10 (−0.40, 0.20)	−0.19 (−0.55, 0.16)	−0.13 (−0.42, 0.15)	

Notes:

[a]Difference in slope across the 3 dimensions.