Exploring the Impact of Social Networks on Maternal Attitudes Towards Child Non-NIP Vaccine Uptake: A Mixed-Method Study in Chongqing, China

by

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Defense Date: March 21, 2025

Approved:

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Qian Long, Chair

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the DKU Global Health Program in The Graduate School of
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ABSTRACT

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Abstract

Background: In China, childhood vaccination is essential for preventing communicable diseases, yet significant disparities exist between National Immunization Program (NIP) and non-NIP (self-paid) vaccine uptake. While NIP vaccines have high coverage due to government support, non-NIP vaccine uptake remains lower, particularly in economically disadvantaged areas. Social networks play a crucial role in shaping maternal attitudes toward vaccination, but their impact remains underexplored, especially in the context of urban-rural differences.

Methods: This study employs a mixed-methods approach, combining quantitative surveys (N=570) and longitudinal qualitative interviews (N=30) conducted in Yuzhong (high-income, urban) and Dazu (low-income, rural) districts of Chongqing. The quantitative analysis examines the relationship between maternal social networks and non-NIP vaccine uptake, while the qualitative component explores dynamic changes in mothers' decision-making processes across three interview rounds.

Results: Quantitative findings indicate that discussions with spouses, family, and media significantly influence non-NIP vaccine uptake, while social network breadth alone has no direct effect. Peer vaccination rates and maternal education levels also play a key role in decision-making. Qualitative analysis reveals that healthcare professionals, social circles, and online information evolve as primary sources over time, with mothers becoming more independent in decision-making. Trust in healthcare professionals remains high, but mothers increasingly integrate peer experiences and online information. Regional disparities persist, with Yuzhong mothers demonstrating higher vaccine acceptance over time compared to Dazu mothers.

Conclusions: Social networks are pivotal in shaping maternal vaccine decisions, with trust and information quality outweighing the sheer number of information sources. Spouses and peer influence reinforce vaccine confidence, while online misinformation presents challenges. Public

health efforts should leverage trusted social networks, enhance healthcare communication, and provide targeted interventions to bridge regional disparities in vaccine uptake.

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1. Introduction

Over the past few decades, the fertility rates in China remain to be low. The number of newborns in China has dropped from 15.95 million in 2010 to 9.02 million in 2023 (National Bureau of Statistics of China, 2023). Meanwhile, children's health shows distinct regional differences. The rate of pneumonia among children under age 3 in rural Chengdu was reported as 79.81% (National Bureau of Statistics of China, 2024). In contrast, the pneumonia rate among children in urban Chengdu was significantly lower, which is at 21.19% (Li & Wan, 2015). Studies suggest that rural children have lower pneumococcal vaccine coverage than urban children, which might contribute to higher pneumonia incidence in rural areas (Yelverton et al., 2022). Additionally, pneumonia remains the leading infectious cause of death among children under five globally, accounting for an estimated 740,180 deaths in 2019, or 14% of all deaths in the age group between 1 month and 5 years (WHO, 2022). These disparities in the prevalence of communicative diseases might be associated with the urban and rural different tendencies in seeking preventive care—vaccination. Vaccines are usually perceived as effective measures to prevent communicative diseases and certain noncommunicative diseases in children. In China, children's vaccines are categorized into two types: National Immunization Program (NIP) vaccines and Non-National Immunization Program (Non-NIP) vaccines (National Bureau of Statistics of China, 2024). National Immunization Program (NIP) vaccines are typically supported by government funding and promoted nationwide to improve basic immunization coverage (Chen et al., 2024). Non-NIP vaccines, on the other hand, are self-paid vaccines and are not included in the compulsory national vaccination schedule, including vaccines such as pneumococcal vaccines, rotavirus vaccines, flu vaccines and HPV vaccines (Jiang et al.,2023). Given the mandatory nature of NIP vaccines, the vaccination rates of NIP vaccines are very high in both urban and rural areas of China. Studies have found that children in urban areas generally

have higher immunization coverage rates than those in rural areas, particularly for newly introduced vaccines (Wu et al., 2023). This urban-rural gap is primarily observed in non-National Immunization Program (non-NIP) vaccines, which require out-of-pocket payment and proactive parental decision-making. The discrepancy is also likely due to disparities in healthcare resources, access to vaccination services, and public awareness, which are more pronounced in rural regions (Zhang et al., 2022). However, for National Immunization Program (NIP) vaccines, which are free and widely available, coverage rates tend to be more uniform across urban and rural areas, as government policies ensure accessibility regardless of geographic location. However, vaccination rates for non-NIP vaccines, such as pneumonia vaccines and rotavirus vaccines, are significantly lower, especially in low-income areas. Existing research indicate that there are regional differences in the coverage rates of non-NIP vaccines, with the highest coverage in eastern China, followed by central China, and the lowest in western China (Wu et al., 2022). This urban-rural gap in child non-NIP vaccines is not only related to economic and educational levels of parents but is also influenced by social culture, government policies, and social networks.

Family plays an important role in children's vaccination decisions for non-NIP vaccines. Studies have shown that factors such as family economic status, place of residence, number of children, and parents' level of knowledge about vaccination can influence the non-NIP vaccination rates in China (Zhou et al.,2018; Zhang et al.,2016). For example, families with lower per capita annual income, living in rural areas, and having multiple children tend to have lower vaccination rates for flu and pneumonia vaccines in China (Cai et al., 2023). Studies also show that families with higher income and education levels are more likely to vaccinate their children with non-NIP vaccines because they have better access to medical information and could afford vaccine costs (Zhou et al., 2023). When examining child vaccination, past research has often considered the family as a single unit, without identifying the independent effects of mothers on

children's vaccination (Deng et al., 2023; Tal et al., 2021). However, existing research has suggested that mother's characteristics may independently influence children's health (Goodwin et al., 2005). Mothers often seek vaccine-related information through friends, family, and social media platforms, and make decisions through social interaction (Smith et al., 2024). Mothers in rural areas often rely on grassroots healthcare workers as key sources of vaccine-related information due to their close ties with local communities. Compared to urban areas, grassroots healthcare workers in rural areas have closer ties with residents, and rural residents are more trusting of healthcare workers in promoting non-NIP vaccines (Zhang et al., 2018). Research suggests that the different social networks of rural and urban mothers may lead to differences in vaccine information access, attitude formation, and vaccination behavior (Wang et al., 2023).

Social networks play two roles in vaccination behavior: on the one hand, they serve as an important channel for spreading health information, helping to increase vaccination rates (Huang et al., 2023); on the other hand, social networks can also spread negative information or foster vaccine hesitancy (Ahmad et al., 2024). Therefore, how to leverage the influence of social networks, particularly through effective information dissemination and public opinion guidance, is a key challenge in public health policy design. As a result, it is crucial to conduct in-depth research on how mothers' social networks shape their perceptions of non-NIP vaccines and how these influences differ across regions with varying economic levels. Existing research on mothers' social networks and child vaccination has several limitations. First, there is a lack of studies employing mixed-method approaches, making it difficult to capture the dynamic decision-making process of mothers regarding child vaccination (Li & Wang, 2015; Smith et al., 2024). Second, existing research has paid limited attention to the role of digital networks or social media (Memedovich et al., 2024). With the increasing prevalence of social media and online health communities, mothers now have access to a broader range of vaccine-related information and

peer discussions. However, the influence of these digital networks on vaccine hesitancy, trust in medical professionals, and decision-making processes remains underexplored.

To fill these gaps, this study will examine how mothers' social networks influence their vaccination behavior toward non-NIP vaccines in two districts in the largest city in Southwest China: Yuzhong (relatively high-income urban district) and Dazhu (relatively low-income rural district) districts in Chongqing. Relying on data from a longitudinal survey and longitudinal qualitative interviews, I analyze the main sources of acquiring vaccine information, social interaction patterns, and the impact of various social networks on mother's attitudes towards vaccinating their young child at month 5–6. The study aims to compare mother's social networks in both urban and rural regions and explore their role in vaccination decision-making and vaccination behaviors, providing new perspectives to increase non-NIP vaccine uptake, such as optimizing health communication with mothers, enhancing healthcare-community interactions, and leveraging social media to spread scientific vaccine information.

1.1 Literature Review

In China, childhood vaccination is a fundamental public health measure that protects children from vaccine-preventable diseases (VPDs). National Immunization Program (NIP) vaccines are those used in immunization plans, primarily targeting young children, established by the government for specific infectious diseases, such as Hepatitis B vaccine and BCG vaccine (National Bureau of Statistics of China, 2024). NIP vaccines are mandatory vaccines provided by the government, with costs covered by the state. In contrast, non-immunization program (non-NIP) vaccines are voluntary and self-funded (Zhang et al., 2022). In contrast to the high vaccination rates for NIP vaccines, the vaccination rate for non-NIP vaccines among children is relatively low, showing significant regional variations (Hu et al., 2015). For example, a survey of 4,681 children aged 1 to 2 years found that approximately 61.4% of children had received at least

one non-NIP vaccine. However, in another survey involving 2,160 children aged 0 to 3 years across the Eastern, Central, and Western regions of China, the coverage rate in the Western region was only 49.6% (Chen et al., 2022). Existing studies show that expanding the National Immunization Program to include non-NIP vaccines may effectively improve the immunization coverage of non-NIP vaccines and prevent vaccine-preventable diseases (Hu et al., 2015). For example, Hu et al. (2015) highlighted that through policy interventions and resource integration, incorporating non-NIP vaccines into the national immunization framework can not only increase vaccination rates but also reduce the disease burden and medical costs caused by preventable diseases. In addition to the recommendation of expanding the NIP vaccine list, other important measures have been identified to improve the vaccination rate of non-NIP vaccines without changing the current vaccination program. For example, some scholar suggested to leverage the influence of healthcare professionals on child vaccination, as studies show that advice from doctors and nurses significantly impacts parents' vaccination decisions (Opel et al., 2015). Furthermore, a more robust vaccination reminder system can be established, such as using text messages, apps, or WeChat mini programs to automatically remind parents of vaccination times, improving the timeliness and coverage of vaccinations (Wu et al., 2023). Using parent groups, community health lectures, and peer influence, by sharing vaccination experiences and expert explanations, can increase mothers' recognition of non-NIP vaccines (Smith et al., 2024). Additionally, the government can cooperate with kindergartens, schools, and other educational institutions to make them important channels for vaccine education (World Health Organization and United Nations Educational, Scientific and Cultural Organization, 2021). This means that the multiple communication channels and networks may facilitate the mothers' engagement into the vaccination practice.

One of the reasons for the insufficient vaccination rates of non-NIP vaccines could be the increasing vaccine hesitancy among parents (Zhang et al., 2022). Data from the Netherlands shows that among the individual and social factors influencing vaccine hesitancy, parents' attitudes toward vaccinating their children are one of the most important reasons (Romijnders et al., 2019). Hesitancy often stems from parents' concerns about vaccine safety and efficacy, manifested in uncertainty about whether to vaccinate. Informed consent is part of this hesitancy, meaning that parents make a voluntary and rational decision after fully understanding the benefits and risks of vaccination. It is crucial to ensure high vaccination rates when parents make decisions based on informed understanding. Additionally, studies have shown that parents with higher levels of vaccine knowledge and a positive attitude toward vaccination are more likely to vaccinate their children, and trust is a crucial factor (Hu et al., 2015).

Parents' hesitancy often arises from their lack of knowledge or negative attitudes. A lack of adequate understanding of vaccines may lead to distrust, which manifests as hesitancy. Research by Romijnders et al. (2019) found that mothers' knowledge and attitudes about vaccination directly affect whether they vaccinate their children, and the caregiving role of mothers in the family is crucial.Forshaw et al. (2017) proposed that a mother's educational level is significantly positively associated with children's vaccination rates, with mothers who have secondary or higher education being more likely to receive complete vaccinations. When mothers have higher educational levels, children's vaccination rates tend to be higher. Therefore, there is a correlation between a mother's role as a caregiver and children's vaccination rates. Increasing mothers' vaccine knowledge and educational levels is an effective way to improve vaccination rates.

Relevant studies also indicate that social networks are highly effective in changing health behaviors across various domains (Latkin & Knowlton, 2015). Latkin & Knowlton discussed the

influence of social norms, modeling, and social rewards within networks. These factors can effectively encourage positive health behaviors. In addition, social networks play a significant role in shaping health behaviors, including attitudes toward vaccination (Memedovich et al., 2024). This means that an individual's attitude toward vaccination often reflects the views of their social network. individuals embedded in networks with prevalent vaccine skepticism were more likely to exhibit hesitancy themselves. It underscores the role of social networks in shaping individual attitudes toward vaccination, particularly in the context of COVID-19. Considering the role of mothers and the importance of social networks in vaccination, exploring how social networks influence mothers' attitudes toward non-NIP vaccinations for children will be an essential component of developing vaccination strategies.

1.2 Research Gap

However, existing research has overlooked the mothers' role and their ambivalent and hesitant attitudes toward vaccines. Hesitancy may lead to complete refusal to vaccinate, delayed vaccination, or confusion or unease in the decision-making process (Garcia et al., 2023). Most past studies on vaccination have seldom considered gender differences when taking family factors into account. Relevant research has already shown that the influence of mothers on children's health and cognitive abilities may be greater than that of fathers (Amoah & Asamoah, 2022). In terms of mothers' decision-making attitudes, there is still a research gap, which is an important explanatory perspective in my current study. The study by Amoah and Asamoah (2022) pointed out that the degree of importance mothers place on children's health, as well as their trust in medical advice, significantly affect whether children are vaccinated on time. Especially in low-income groups, mothers' attitudes and acceptance of vaccines are directly related to the improvement of vaccine coverage. Similarly, in my study, I will focus on the role of mothers in children's vaccination decisions.

Furthermore, according to data from a study that used a qualitative in-depth interview method to collect original data from 30 rural parents in a village in Henan Province, China, vaccination rates for all non-NIP vaccines are lower in rural areas (i.e., economically underdeveloped areas) in China, compared to urban families (Wang et al., 2023; Zhou et al., 2023). Therefore, regional differences in non-NIP vaccination rates will also be considered. Additionally, the non-NIP vaccination rate is generally higher in the economically developed eastern regions than in the less-developed central and western regions (Zhou et al., 2023; Yang & Wang, 2021). Previous studies have mostly focused on economically developed areas in East China, such as Zhejiang Province (Zhou et al., 2023). My current study focuses on a representative city in Southwest China which is the economically less developed region of China, choosing both economically developed urban and rural areas to account for vaccination heterogeneity.

Lastly, research on mothers' attitudes toward non-NIP vaccine uptake is relatively limited, especially regarding how social networks influence mothers' vaccination decisions for specific non-NIP vaccines. However, studies indicate that these networks play a crucial role in shaping maternal vaccination decisions. Studies have found that exposure to negative social media discourse about the HPV vaccine correlates with decreased maternal trust in healthcare providers and lower vaccination rates for their daughters (Walker et al., 2020). Mothers who first learned about the HPV vaccine through social media were less likely to vaccinate their daughters compared to those who received information from healthcare providers, highlighting the importance of trusted sources in influencing vaccination behavior.

2. Research Design

2.1 Study Design and Data Collection

Current study is embedded in a large vaccine project about acceptability and equity of non-National Immunization Program Vaccines in Chongqing, China. In this large project, we collected data from mothers whose newborns are between month 2 and month 6, living in Yuzhong district and Dazu district of Chongqing. Mothers were excluded if they were unable to provide informed consent or comprehend the study content. We chose Yuzhong District and Dazu District of Chongqing to compare the differences in attitudes toward non-NIP vaccination between relatively developed and underdeveloped regions. Yuzhong District, as one of the main districts in Chongqing, is economically developed. In 2022, the GDP of Yuzhong District reached 156.09 billion RMB, with a permanent population of 577,700 (CEIC Data, 2024). The tertiary sector accounted for 91.9% of the GDP, showing strong economic vitality and a solid service industry foundation. In contrast, Dazu District, once a county in Chongqing, is economically underdeveloped. In 2022, its GDP was 81.72 billion RMB, with a permanent population of 834,400, and the tertiary sector accounted for 43.9% of the GDP (CEIC Data, 2024). These differences in economic and population data lead to significant disparities between Yuzhong and Dazu districts in terms of social resources, information dissemination channels, and health interventions, providing a valuable comparative background for this study.

In this project, I along with the PIs and other research assistants, have participated in the survey design and qualitative interview. Starting from December 2023, we surveyed mothers whose newborns just reached 2-month-old. The survey questionnaire contains 4 sections: sociodemographic information, vaccination status, sources of vaccine information and awareness, future willingness, and vaccine hesitancy. We tracked these mothers when their children reached 4-5 months old and 6-7 months old, respectively. The questionnaires in wave 2 and wave 3 have

repeated some questions in wave 1. However, new questions, such as parental knowledge about NIP vaccines and non-NIP vaccines, perceived risks of different communicative diseases, and social networks of mothers, were added to later waves. The questionnaire has mainly focused on mother's attitudes, knowledge, reluctancy, and social networks. Their children's vaccination behaviors were collected and compiled from actual vaccination record when newborns were around 5-6 months old. The questionnaire data were merged with the vaccination record data, linking the attitudes with the vaccination behavior. The key focus of this study—social network—were mostly collected in wave 3, when the newborns were between month 5 and month 6. After deleting the mothers with missing values on key variables, the final analytical sample contains 291 mothers from Yuzhong and 279 mothers from Dazu, respectively.

In addition to the quantitative survey data, we have also collected qualitative data from 30 mothers (all three rounds are involved). Similar as the panel survey discussed above, we have selected 30 mothers who have participated in the survey and interviewed them while their children were in 2-month, 4-5 month, and 6-7 month old, respectively.

2.2 Quantitative Measurements and Methods

I have created two dependent variables. The first dependent variable is constructed upon the number of non-NIP vaccines 5–6-month-old child ever vaccinated, including quintuple, quadtuple, pcv13, rotavirus vaccines, acyw135 vaccine, and EV71 vaccines. For this dependent variable, the number of non-NIP vaccines will be divided into two categories: one category refers to child who have received 0–2 non-NIP vaccines (value is 0 and means rarely) and the other category refers to child who have received 3–8 non-NIP vaccines (value is 1 and means abundant). The second dependent variable is if the child at month 5-6 has ever vaccinated quintuple or quadtuple vaccine. I chose the quintuple and quadtuple vaccination because it is one of the most popular non-NIP vaccines among young children given its lower number of doses and

convenience to parents. Based upon the vaccination record, if neither vaccine was vaccinated, the responses are defined as “no” and coded as 0. If either or both vaccines were taken, the responses are defined as “yes,” then the value is 1.

Social networks can be formal (e.g., workplace, organizations) or informal (e.g., friends, family, neighbors) (Chiu & West, 2007). Social capital consists of social networks, social participation, and social trust, as it is considered one of the individual-level factors. Berkman & Glass (2000) defined social networks as the web of person-centered social ties. Its assessment and impact extend to the number of network members, homogeneity of members, frequency of contacts amongst members, the extent of reciprocity of these contacts, as well as the duration of the contacts. Social capital includes the characteristics of relationships and interactions between individuals and groups. It is considered a personal resource that can be accessed through various social networks, where individuals have good access to support and services (Okafor & Rihan, 2023). Based on these, my key independent variables encompass (1) social network type, including 6 types (frequency of discussions with spouse, family, friends, doctors, social media and others.) For each type, never discussing is assigned a value of 1, sometimes discussing is assigned a value of 2, and always and frequently discussing is assigned a value of 3. (2) social network breadth. Social network breadth is measured by the frequency of vaccine discussion across multiple channels (spouse, family, friend, doctors, media, and others). This variable is aggregated based on the discussion frequency across six different channels. The rules are as follows: if the response is “always” or “frequently,” it is assigned a value of 1; otherwise (including “never,” “occasionally,” or “rarely”), it is assigned a value of 0. The social network breadth is created by adding the six channels up, ranging from 0 to 6. Finally, the range of 0 to 6 is categorized into three levels: values less than 2 are defined as thinnest, values between 2 and 4 are defined as narrow, and values greater than 4 are defined as wide. (3) peer vaccination rates

(vaccinated children in the mother's social circle). The example of ever vaccinated with quintuple or quadruple vaccine will be used. If there are no children (0%) vaccinated among the mother's acquaintances and social circle, the value is assigned as 0 and named as "no". If only a few (<30%) or some children (30%-50%) are vaccinated, the value is assigned as 1 and is named as "some or a few". If most (>50%) or all (>90%) children are vaccinated, the value is assigned as 2 and is named as "most or all". The assignment method for the number of children vaccinated with the EV71 vaccine among the mother's friends and acquaintances follows the same principle.

The study controls for personal characteristics such as age, mother's highest education(which is divided into 3 group: elementary school or less/junior high=1; senior high/vocational school=2;junior college/college/master or above=3), family income (including all economically contributing members of the family) , number of children (1 child=1, 2 children=2, 3 or more children=3) and regional factors (Yuzhong District vs. Dazu District). Control variables include the number of children, birth order, self-perceived economic levels, and the mother's income etc.

I employ logistic regression models since my two dependent variables are binary. Different models are constructed to examine the effects of social network discussion types, social network breadth, and exposure to vaccinated children in social circles (peer vaccination rates) on vaccination outcomes. Additionally, the models report odds ratios (ORs) to interpret the likelihood of vaccination based on different social network characteristics.

2.3 Qualitative Measurements and Methods

In the process of qualitative data collection, I used in-depth interviews, with observations conducted every two to three months from December 2023 to May 2024. Participants are mothers aged 18 and above, with children between 2 months and 3 months old who have received a vaccination during the first survey round. This study adopted a purposive sampling strategy

combined with convenience sampling for participant selection. Specifically, the research team selected eligible mothers (e.g., those with infants of the appropriate age and willingness to participate) from those who had completed the quantitative survey and invited them to take part in three rounds of qualitative interviews. This approach ensured that participants possessed relevant background information and improved the feasibility of conducting longitudinal interviews. Convenience sampling enabled the researchers to quickly obtain contextually relevant and informative data, which is particularly suitable for field studies conducted under time or resource constraints, although it may limit the generalizability of the findings (Etikan, Musa, & Alkassim, 2016). To mitigate potential selection bias—such as the tendency for participants to have higher health awareness or a stronger interest in vaccination—the research team recruited mothers from two distinct districts in Chongqing (Yuzhong and Dazu) and made efforts to include a diverse range of participants in terms of education, income, and parenting experience. We have selected 42 mothers. Convenient sampling was used; mothers who were able to attend the interviews on site were invited through healthcare professionals in Dazu District and Yuzhong District. Due to the high degree of information redundancy, no additional participants were included in the second and third rounds of interviews. Eventually, 42 mothers participated in the first wave of interview, 33 mothers participated in the second wave, and 30 mothers participated in the last wave of interview. The attrition rate is low. The attrition in later waves is random, causing small bias in the data.

Table1 summarizes the key sociodemographic characteristics of the qualitative sample. A total of 42 mothers participated, with 21 from Dazu District and 21 from Yuzhong District. Table1 shows participation rates across three interview rounds, the number of children per participant, and parental age ranges. Maternal ages ranged from 21 to 38 in Dazu and from 22 to 44 in Yuzhong, reflecting slight differences in age distribution across districts. These

characteristics provide context for understanding the social background of mothers involved in the study.

Table1 Qualitative sample characteristics

District	Sample size	First round participation rate	Second round participation rate	Third round participation rate	Number of children Radius	Maternal age range	Paternal age range
Dazu District	21	21(100%)	15(71.4%)	13(61.9%)	1-4	21-38	27-39
Yuzhong District	21	21(100%)	18(85.7%)	17(81.0%)	1-2	22-44	28-47

Interview transcripts were analyzed using Nvivo14 software, followed by coding with grounded theory methods, including open, axial, and selective coding to establish categories and relationships, and explore how social networks influence mothers' attitudes toward receiving non-NIP vaccines.

2.3.1 Open Coding

First of all, on the premise of keeping the meaning of the original materials as much as possible, the interview text is refined to form a more concise concept, and finally 32 initial concepts are obtained, and it is coded as a1-a32(TableB.1 in Appendix B). Then the concepts are categorized. By analyzing and comparing the concepts, the same or similar concepts are grouped into corresponding categories. A total of 21 categories are summarized and numbered A1-A21(TableB.1 in Appendix B).

During the open coding stage, interview transcripts were reviewed line by line to identify meaningful segments related to mothers' decision-making about non-NIP vaccines. These codes were then grouped into initial categories that reflected common patterns of social interaction, information flow, and personal experience. For example, the category "Suggestions from medical staff" included codes such as "Doctor told me it was necessary to call" and "The pediatrician said vaccination was unnecessary" (a1, a2) (TableB.1 in Appendix B), capturing the authoritative role

of professionals in shaping early perceptions. Another category, “Information exchange among friends,” featured quotes like “A lot of friends had problems after vaccination” and “I asked whether there were side effects” (a7, a8) (TableB.1 in Appendix B), highlighting how peer experiences influenced mothers' attitudes.

Additionally, categories such as “Acceptance of network information” and “Recommendations from domestic workers” illustrated the diversity of sources mothers consulted, ranging from Baidu and Xiaohongshu to family and childcare helpers. These open codes laid the foundation for axial coding, where recurring themes such as trust, emotional support, and the search for credible information began to emerge across interviews(TableB.1 in Appendix B).

2.3.2 Axial Coding

Axial coding is a secondary analysis based on open coding. It involves integrating independent, scattered, and conceptually unclear open codes to further analyze the internal connections at the initial category level. Based on classification and relational associations, categories are abstracted and summarized into higher-level core categories. The categories and concepts generated from open coding are clustered mainly by merging similar items and combining codes with similar meanings. Ultimately, seven core categories were identified.

Following the open coding process, axial coding was conducted to organize and integrate initial codes into broader thematic categories. Through constant comparison and conceptual grouping, codes with conceptual similarities were clustered under main categories that reflected the relational dynamics of vaccine decision-making. For instance, codes such as “advice from healthcare professionals” and “presentation of official information” were merged under the main category of “Presentation by healthcare professionals,” highlighting their central role in initiating and shaping mothers' perceptions(TableB.2 in Appendix B). Similarly, codes relating to

neighborhood vaccination, colleague discussion, and mother-to-mother exchange were grouped as “Inoculation peripherals,” reflecting the importance of informal peer interactions(TableB.2 in Appendix B).

In total, 21 sub-categories were identified and categorized under thematic clusters such as “Network information impact,” “Communication between spouses and family members,” and “Acceptance of information.” This stage of coding emphasized the interplay between formal information sources (e.g., doctors, official platforms) and informal social influences (e.g., peer groups, domestic workers), providing a structured understanding of how various actors and media shaped vaccine attitudes(TableB.2 in Appendix B).

2.3.3 Core Coding

Selective coding refers to the process of systematically analyzing all identified concepts and categories to select a “core category.” Through continuous analysis, related subordinate categories and concepts are integrated to systematically explain and validate the relationships between the main category and the subordinate categories. This process also involves filling in categories that need further refinement or development in the future (Chen, 1999). The goal is to further clarify the relationships between core categories (Wang & Ru, 2015). By gradually clustering the coding nodes, two core categories identified in the interview content are “Sources of Vaccine-Related Information” and “Mothers’ Information Acceptance and Vaccination Attitudes.” (TableB.3 in Appendix B).

In the second and third rounds of interviews, new vaccine-related sources like apps and peer discussions emerged but concerns about information overload and accuracy remained. School mandates influenced vaccination decisions, while mothers relied more on friends’ experiences than online information. Healthcare professionals’ input was valuable but limited by time constraints, and negative online content made some mothers more cautious. As decision-

making became more complex, integrating medical advice, personal experiences, and online information, more mothers vaccinated, but concerns about safety, costs, and adverse reactions persisted.

2.3.4 Saturation Assessment

The interview participants were selected from those who had completed the quantitative survey, primarily on a voluntary basis (with a small reward offered). Priority was given to first-time mothers in Dazu District and Yuzhong District. Due to the nature of the follow-up interviews, data analysis was conducted after the completion of data collection(TableB.4-6 in Appendix B).

To ensure the reliability and validity of the study, a saturation assessment was conducted on the interview data (Constantinou, 2017). Theoretical saturation is generally considered to be reached when newly collected data no longer yield new concepts or categories. Therefore, after completing the selective coding phase, a portion of the reserved data was used to test for theoretical saturation. Following the procedures and principles of grounded theory, the reserved data were subjected to three levels of coding. The results showed that no new themes emerged during this process. This indicates that the valuable information in the interviews had been thoroughly captured, and the codes related to how social networks influence mothers' attitudes toward non-NIP vaccination reached theoretical saturation.

3. Results

3.1 Quantitative Analysis Section

3.1.1 Demographic Characteristics

Table2 Demographic characteristics

	Total (n=570) N(%)	number of non-NIP vaccines		P value
		0-2 (n=155) N (%)	3-8 (n=415) N (%)	
Vaccinated quintuple or quadtuple vaccine				0.000***
No	374(66%)	149(26%)	225(40%)	
Yes	196(34%)	6(1%)	190(33%)	
Social network breadth				0.225
Thinnest	366(64%)	108(19%)	258(45%)	
Narrow	178(31%)	42(7%)	136(24%)	
Wide	26(5%)	5(1%)	21(4%)	
Discuss with spouse				0.130
never	67(12%)	23(4%)	44(8%)	
sometimes	409(72%)	113(20%)	296(52%)	
always	94(16%)	19(3%)	75(13%)	
Discuss with family				0.059
never	91(16%)	34(6%)	57(10%)	
sometimes	423(74%)	107(19%)	316(55%)	
always	56(10%)	14(3%)	42(7%)	
Discuss with friends				0.078
never	90(16%)	33(6%)	57(10%)	
sometimes	398(70%)	103(18%)	295(52%)	
always	82(14%)	19(3%)	63(11%)	
Discuss with others				0.105
never	72(13%)	27(5%)	45(8%)	
sometimes	424(74%)	110(19%)	314(55%)	
always	74(13%)	18(3%)	56(10%)	
Discuss with doctors				0.015*
never	12(2%)	6(1%)	6(1%)	
sometimes	255(45%)	80(14%)	175(31%)	
always	303(53%)	69(12%)	234(41%)	
Learn from the media				0.005**
never	51(9%)	23(4%)	28(5%)	
sometimes	388(68%)	104(18%)	284(50%)	
always	131(23%)	28(5%)	103(18%)	
Mother's education levels				0.000***
Junior high or less	102(18%)	41(7%)	61(11%)	
Senior high	136(24%)	45(8%)	91(16%)	
Junior college or more	332(58%)	69(12%)	263(46%)	
Self-perceived economic levels				0.842
Below average	132(22%)	38(6%)	94(16%)	

Average level	397(70%)	107(19%)	290(51%)	
Above average	41(8%)	10(2%)	31(6%)	
Number of children				0.456
1	311(55%)	78(22%)	233(33%)	
2	207(36%)	62(2%)	145(34%)	
3	52(9%)	15(3%)	37(6%)	
Living district				0.000***
Yuzhong distrct	291(51%)	54(9%)	237(42%)	
Dazu district	279(49%)	101(18%)	178(31%)	
Mother's mean age (SD)	31(4.83)	30(5.15)	31(4.64)	0.001**
Mother's income[a] (SD)	0.96(2.69)	0.70(2.35)	1.57(2.80)	0.170
Family income[b] (SD)	11.52(0.98)	11.45(0.63)	11.54(1.08)	0.307

Note: [a.] The mother's individual income has been taken the logarithm form. [b] Family income has been taken the logarithm form.

*p<0.05;**p<0.01;***p<0.001

After three rounds of data collection, 570 valid questionnaires were obtained, with two groups: one whose children received 0-2 categories (n=155) and another 3-8 categories (n=415). Key findings include a significant positive correlation between maternal education and vaccine uptake ($P < 0.05$). Families with higher economic levels and those in more developed areas, like Yuzhong District, were more likely to vaccinate their children for more than 3 types of non-NIP vaccines. Mothers in the 3-8 categories vaccines group were slightly older (average age 31), and higher family income was also positively correlated with the likelihood of taking more than 3 non-NIP vaccines ($P < 0.05$). Overall, maternal education, family economic status, and regional factors significantly promoted non-NIP vaccine uptake.

3.1.2 Empirical Results Analysis

Table3 Logistic regression of non-NIP vaccines on social network types

	(1) Model1	(2) Model2	(3) Model3	(4) Model4	(5) Model5	(6) Model6
Discuss with spouse						
never(baseline)						
sometimes	1.551					
	(0.139)					
always	1.936**					
	(0.083)					
Discuss with family						
never(baseline)						

sometimes		1.846*				
		(0.017)				
always		1.676				
		(0.193)				
Discuss with friends						
never(baseline)						
sometimes			1.869**			
			(0.017)			
always			1.669			
			(0.151)			
Discuss with others						
never(baseline)						
sometimes				1.936**		
				(0.019)		
always				1.648		
				(0.193)		
Discuss with doctors						
never(baseline)						
sometimes					1.990	
					(0.261)	
always					2.248	
					(0.189)	
Learn from the media						
never(baseline)						
sometimes						2.238**
						(0.012)
always						2.653***
						(0.009)
District						
Yuzhong District(baseline)						
Dazu District	0.518***	0.519***	0.507***	0.505***	0.540***	0.508***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.008)	(0.003)
Mother's age	1.075***	1.075***	1.075***	1.077***	1.073***	1.073***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)
Mother's income	1.039	1.039	1.039	1.041	1.044	1.038
	(0.344)	(0.345)	(0.356)	(0.325)	(0.295)	(0.357)
Family income	0.920	0.913	0.900	0.905	0.916	0.905
	(0.542)	(0.511)	(0.451)	(0.478)	(0.529)	(0.487)
Constant	0.486	0.507	0.579	0.493	0.385	0.457
	(0.671)	(0.687)	(0.746)	(0.678)	(0.594)	(0.652)
Control variable	YES	YES	YES	YES	YES	YES
Observations	570	570	570	570	570	570
Pseudo R^2	0.0676	0.0712	0.0712	0.0708	0.0656	0.0740

Note: Control variables include: the number of children, mother's educational levels, the self-perceived economic levels of the family, mother's income in last month(logarithm form), family income (logarithm form). Inside the parenthesis is the standard deviation.

*p<0.05;**p<0.01;***p<0.001

Table3 analyzes the impact of 6 network types on vaccine uptake, controlling for the district, mother's age, mother's educational attainment, the number of children, the self-perceived economic levels of the family, mother's individual income, and family income. The findings in Model 1 reveal that frequent discussions with spouses significantly promote non-NIP vaccination. Compared to those who never discuss with spouse, mothers who always discuss non-NIP vaccines are 94% more likely to vaccine 3–8 categories of vaccines on their children relative to 0–2 categories of vaccines. However, occasional discussions (sometimes) with spouses show a positive but non-statistically significant effect. I have added discussion vaccines with family, discussion with friends, and discussion with others to model 2-4 respectively, while controlling for other control variables. The results in Model 2-4 showed that occasional discussions with family, friends, or others are all positively correlated with vaccination. However, always discussing vaccines with family, friends, and others are not statistically significant, though the odds ratios are all bigger than 1. In Model 5, I have added discussion with doctors to the baseline model. The results suggested that compared to those who never discuss with doctors, mothers who sometimes discuss non-NIP vaccines with the doctors are 99% more likely to vaccine their children for 3-8 categories of vaccines. However, the variable is not statistically significant. Model 6 shows compared to those who never discuss with media, mothers who sometimes discuss non-NIP vaccines are 1.24 times more likely to vaccine their children for 3-8 vaccines compared to those who vaccines 0-2 types of vaccines. Media information has the strongest influence, with frequent media use showing a significant positive correlation with vaccination behavior. In summary, discussions with different people or parties about child vaccines, except for doctors, generally promote more uptake of non-NIP vaccines.

Additionally, the mother's age is positively correlated with the number of vaccines administered ($p < 0.05$). Older mothers are more likely to vaccinate their children 3 or more non-

NIP vaccines when their children are between 5-6 months old when other variables are controlled. This might be due to the fact that older mothers are more likely to have increased health awareness, which is linked to increased compliance with vaccination recommendations.

Table4 Regression of stratified social network breadth on number of non-NIP vaccines

	(1)	(2)	(3)
	Model1	Model2	Model3
VARIABLES	All	Yuzhong	Dazu
Social network breadth			
Thinnest (Baseline)			
Narrow	0.888(0.622)	1.130(0.762)	0.553*(0.078)
Wide	0.978(0.969)	0.913(0.911)	1.888(0.494)
How many children in your circle of friends and acquaintances have been vaccinated EV71?			
No children (Baseline)			
a few or some	1.677(0.110)	0.405(0.177)	3.034***(0.006)
Most or all	1.590(0.199)	0.477(0.288)	2.610**(0.042)
Mother's highest education			
Junior high or less (Baseline)			
senior high	1.537(0.152)	4.295**(0.033)	1.120(0.745)
junior college or more	1.998**(0.017)	4.823***(0.006)	1.496(0.268)
District			
Yuzhong District(baseline)			
Dazu District	0.773(0.309)		
Mother's age	1.080***(0.002)	1.102**(0.024)	1.060*(0.071)
Mother's income	1.033(0.431)	1.034(0.595)	1.032(0.607)
Family income	0.915(0.551)	1.067(0.660)	0.725(0.193)
Constant	0.276(0.476)	0.012**(0.047)	4.819(0.565)

Control variable	YES	YES	YES
Observations	569	291	278
Pseudo R^2	0.118	0.207	0.0863

Note: Control variables include: the number of children, mother's educational levels, the self-perceived economic levels of the family, mother's income in last month(logarithm form), family income (logarithm form). Inside the parenthesis is the standard deviation.
*p<0.05;**p<0.01;***p<0.001

The analysis results in Table4 reveal the significant impact of social network breadth, spouse importance, peer vaccination rates, and maternal characteristics on the number of Category II vaccines administered. Model 1 shows the regression of stratified social network breadth on the number of vaccines administered, while Models 2 and 3 present the logistic regressions for Yuzhong District and Dazu District, respectively.

Firstly, when social network breadth is at a moderate level, it may negatively impact vaccination. However, a wide social network breadth does not show a significant effect. Secondly, the importance of the spouse has a positive influence on vaccine decision-making, indicating that the spouse's opinion is crucial in vaccination decisions. Peer vaccination rates have a significant positive impact on the number of vaccines administered, but this effect varies by region. Specifically, in Dazu, the effect is more pronounced when the vaccination rate within the social circle is low (<50%). However, in Yuzhong, social circle vaccination rates do not show a significant influence. Additionally, both the mother's education level and age are significantly correlated with the number of vaccines administered.

Overall, having a narrow social network breadth may negatively impact vaccination uptake, while a wide social network breadth does not show a statistically significant effect. The role of spouses in vaccination decisions is crucial and should not be overlooked. Higher peer vaccination rates significantly promote vaccine uptake, especially in social environments where vaccination

rates are initially low. Additionally, mothers with higher education levels and older age are more likely to administer a greater number of non-NIP vaccines to their children.

Table5 Regression of network types on vaccinated quintuple or quadruple vaccine

VARIABLES	(1) Model1 vaccinated quintuple or quadtuple vaccine	(2) Model2 vaccinated quintuple or quadtuple vaccine	(3) Model3 vaccinated quintuple or quadtuple vaccine	(4) Model4 vaccinated quintuple or quadtuple vaccine	(5) Model5 vaccinated quintuple or quadtuple vaccine	(6) Model6 vaccinated quintuple or quadtuple vaccine
Discuss with spouse						
never(baseline)						
sometimes	0.954					
	(0.896)					
always	2.259**					
	(0.033)					
Discuss with family						
never(baseline)						
sometimes		1.787*				
		(0.071)				
always		1.952				
		(0.159)				
Discuss with friends						
never(baseline)						
sometimes			1.806*			
			(0.063)			
always			1.919			
			(0.101)			
Discuss with others						
never(baseline)						
sometimes				1.857*		
				(0.077)		
always				2.353*		
				(0.054)		
Discuss with doctors						
never(baseline)						
sometimes					2.763	
					(0.393)	
always					4.217	
					(0.223)	
Learn from the media						
never(baseline)						
sometimes						2.813**
						(0.019)
always						3.460***
						(0.010)
District						

Yuzhong District(baseline)						
Dazu District	0.053***	0.053***	0.052***	0.053***	0.061***	0.052***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mother's age	1.039	1.043	1.041	1.042	1.039	1.040
	(0.176)	(0.134)	(0.155)	(0.140)	(0.174)	(0.167)
Mother's income	1.016	1.011	1.010	1.011	1.021	1.005
	(0.702)	(0.792)	(0.804)	(0.789)	(0.613)	(0.907)
Family income	0.906	0.918	0.920	0.915	0.930	0.927
	(0.423)	(0.475)	(0.480)	(0.454)	(0.546)	(0.541)
Constant	0.187	0.095	0.095	0.092	0.046	0.056*
	(0.319)	(0.149)	(0.147)	(0.146)	(0.132)	(0.092)
Control variable	YES	YES	YES	YES	YES	YES
Observations	570	570	570	570	570	570
Pseudo R^2	0.355	0.347	0.347	0.347	0.348	0.352

Note: Control variables include: the number of children, mother's educational levels, the self-perceived economic levels of the family, mother's income in last month(logarithm form), family income (logarithm form). Inside the parenthesis is the standard deviation.
*p<0.05;**p<0.01;***p<0.001

In Table5, the impact of 6 types of networks on vaccinated quintuple or quadruple vaccine was analyzed, while controlling for the mother's age and education level. The results of Model 1 indicate that frequent discussions with spouses significantly promote non-NIP vaccination. Compared to mothers who never discuss vaccines with their spouses, those who always discuss non-NIP vaccines with their spouses are 1.259 times more likely to vaccinate their children with 3–8 categories of vaccines. However, the effect of occasional (sometimes) discussions with spouses is positive but not statistically significant. In Models 2–4, I sequentially added variables for discussions with family, friends, and others while controlling for other control variables. The results show that occasional discussions with family, friends, or others are all positively correlated with vaccination uptake. However, the effect of always discussing vaccines with family, friends, or others is not statistically significant, although the odds ratios for these variables are all greater than 1. In Model 5, I incorporated discussions with doctors into the baseline model. The results suggest that, compared to mothers who never discuss vaccines with doctors, those who occasionally discuss non-NIP vaccines with doctors are 1.763 times more likely to vaccinate their children with 3–8 categories of vaccines. However, this variable is not statistically significant. Model 6 shows that,

compared to mothers who never discuss vaccines with media sources, those who occasionally discuss non-NIP vaccines through media are 1.81 times more likely to vaccinate their children with 3–8 categories of vaccines. The influence of media information is the strongest, with frequent media use showing a significant positive correlation with vaccination behavior.

In summary, discussions with spouses and a higher vaccination rate among friends are strongly associated with vaccination decisions.

Table6 Regression of stratified social network breadth on vaccinated quintuple or quadruple vaccine

VARIABLES	Model1 vaccinated quintuple or quadtuple vaccine All	Model2 vaccinated quintuple or quadtuple vaccine Yuzhong	Model3 vaccinated quintuple or quadtuple vaccine Dazu
Social Network Breadth			
Thinnest (Baseline)			
Narrow	1.168(0.553)	1.111(0.726)	1.354(0.613)
Wide	1.303(0.632)	1.701(0.402)	
How many children in your circle of friends and acquaintances have been vaccinated quintuple or quadtuple vaccine?			
No children (Baseline)			
a few or some	1.940**(0.021)	1.291(0.444)	8.867***(0.006)
Most or all children	7.084***(0.000)	7.376***(0.000)	4.440(0.293)
Mother's education levels			
Junior high or less (Baseline)			
senior high	3.289**(0.030)	1.884***(0.006)	0.314(0.364)
junior college or more	6.675***(0.000)	8.913***(0.001)	4.114*(0.094)
Mother's age	1.038(0.207)	1.041(0.228)	1.034(0.661)
District			
Yu Zhong District (baseline)			
Dazu District	0.080***(0.000)		
Mother's age	1.038(0.207)	1.041(0.228)	1.034(0.661)
Mother's income	1.007(0.864)	1.024(0.633)	1.065(0.593)
Family income	0.906(0.392)	0.912(0.448)	0.731(0.462)
Constant	0.064*(0.090)	0.035*(0.067)	0.132(0.664)
Control variable	YES	YES	YES
Observations	569	291	227
Pseudo R^2	0.403	0.186	0.227

Note: control variables include: the number of children, mother's educational levels, the self-perceived economic levels of the family, mother's income in last month (logarithm form), family income (logarithm form). Inside the parenthesis is the standard deviation.

*p<0.05;**p<0.01;***p<0.001

The analysis results of Table6 reveal the significant impact of social network breadth, peer vaccination rates, and maternal characteristics on vaccinated quintuple or quadruple vaccine. Model 1 presents the regression relationship between stratified social network breadth and vaccinated quintuple or quadruple vaccine, while Models 2 and 3 display the logistic regression results for Yuzhong District and Dazu District, respectively.

Firstly, when social network breadth is at a moderate level, it has a positive impact on vaccination. However, wide social network breadth does not show a statistically significant effect. Secondly, peer vaccination rates have a significant positive effect on vaccinated quintuple or quadruple vaccine, but this effect varies by region. Specifically, In Dazu District, the effect is more pronounced when the peer vaccination rate is low (<50%). In Yuzhong District, the effect is more pronounced when the peer vaccination rate is high (>50%). Additionally, maternal education level is significantly associated with vaccinated quintuple or quadruple vaccine uptake.

Overall, narrow social network breadth may positively influence vaccinated quintuple or quadruple vaccine uptake, while wide social network breadth does not show a statistically significant effect. A higher peer vaccination rate significantly promotes vaccination, especially in social environments where the initial vaccination rate is low. Furthermore, mothers with higher education levels are more likely to vaccinate their children with quintuple or quadruple vaccines.

3.2 Qualitative Analysis

3.2.1 Comparative Analysis of the Results of the Three Rounds of Interviews

3.2.1.1 Dynamic Changes in Information Sources

Healthcare professionals served as key enlighteners in shaping mothers' initial understanding of non-NIP vaccines, drawing on their medical expertise. As the decision-making

process unfolded, mothers became more proactive and inquisitive, bringing increasingly complex and specific questions to healthcare workers. This transformed the professionals' role into that of a consultant. By the later stages, their input became more targeted, offering practical advice on timing, side effect monitoring, and other critical aspects, thereby ensuring mothers made informed, scientifically grounded decisions.

Mothers relied on the experiences of neighbors, coworkers, friends, and peer groups to form initial, fragmented understandings of vaccination. These informal exchanges offered practical reference points for early decision-making. As the process deepened, the value of firsthand insights from others grew exponentially. Mothers increased both the frequency and depth of conversations with those around them, actively seeking social validation and empirical support for their choices.

Online information initially entered mothers' decision-making as a secondary and exploratory channel. It was occasionally consulted to supplement basic knowledge or find current information. However, trust in these sources was low at first due to the overwhelming volume and mixed quality of content. As mothers invested more effort into online searching, they gained exposure to a broader range of views—but also encountered misinformation, biased interpretations, and commercial content. The internet became a double-edged sword: it expanded access to knowledge, but also demanded intensive filtering and verification, creating both opportunities and cognitive burden.

Spouses and family members were naturally involved in mothers' vaccine decisions through close emotional ties. This laid the foundation for early discussions within the household. As the process evolved, these discussions became more in-depth, enriched by relatives' experiences and ongoing input. Spouses often took an active role by following relevant

information and contributing to decision-making. In the later stages, family members continued to provide tailored suggestions grounded in the household's specific circumstances, offering both emotional reassurance and practical guidance.

3.2.2 Summary of Findings from the Interviews

Through the processes of open coding, axial coding, and core coding for the three rounds of interviews, the final coding results of the three rounds are presented in Table7.

Table7 Comparison of coding results from three rounds of interviews

Three-Level Coding	Second-Level Coding	First-Level Coding (Reference Count)		
		First Round of Interviews	Second Round of Interviews	Third Round of Interviews
Sources of vaccine-related information	Introduction by healthcare professionals	Recommendations from healthcare professionals (6) Presentation of relevant information by healthcare professionals (4)	Physician staff referral information (18) Recommendations from healthcare professionals (5)	Reminders from healthcare professionals (5) Introduction by healthcare professionals (9)
	Inoculation of peripherals	Neighbourhood inoculation (1) Information exchange among colleagues (3) Exchange of information among friends (7) Communication among baby mamas (7) Domestic staff recommendation (1)	Neighbourhood exchanges (2) Communication and advice among friends (14) Baby Mothers Talking to Each Other (7) Exchange of information among colleagues (4)	Exchange of information among colleagues (5) Neighbourhood experience sharing (6) Advice from domestic staff (1) Communication among friends (15) Exchanges from surrounding baby mamas (7)
	Network information impact	Information from the Internet (14) Main elements of network information (3)	Information from the Internet (17) Main elements of network information (5)	Information from the Internet (19) Main elements of network information (6)
	WeChat groups and related training	Baby Mothers Group (1) Pregnancy Education Centre	WeChat information sharing (8) Other channels (5)	WeChat information sharing (1) Other channels (8)

	courses	(2) Community preventive health clusters (2)		
	Communication between spouses and family members	Spouse's recommendation (4) Professional advice from family members (3)	Spouse's recommendations (6) Sharing by other relatives (4)	Spouse's recommendations (4) Recommendations from elders (2) Experience of relatives (4)
Mothers' information acceptance and vaccination attitudes	Acceptance of information	Influence of spouses and family members (8) Combined consideration of the situation of people in the neighborhood (5) Lower credibility of online information (4) Higher authority of medical personnel (10)	Mothers Concerned about Vaccine Information (17) Lack of attention to vaccine information by mothers (9) Influence of spouses and family members (13) Higher authority of healthcare workers (6) Incomplete acceptance of doctor's recommendations (2) Vulnerability to online information (2) Low credibility of online information (3) Influence of people around (7)	Influence of people around you (17) Influence of spouses and family members (21) Follow the doctor's advice (3) Higher authority of medical personnel (8) Vulnerability to Internet information (5) Higher trust in friends (3)
	vaccination attitude	Accreditation of Vaccination Category II (2) Non-recognition of Type II vaccination (6) No preference for vaccination (1)	Non-recognition of vaccinations (6) Active vaccination (2) Changes in vaccination attitudes (4)	Active vaccination (12) Non-recognition of vaccinations (6) Combined consideration of vaccination (9) Changes in vaccination attitudes (10)

3.2.3 The Dynamic Influence of Social Networks on Mothers' Vaccination Decisions

The role of social networks in shaping mothers' vaccination decisions evolved across the three rounds of interviews, reflecting a shift from passive observation to active engagement and multi-source evaluation. Initially, mothers relied primarily on healthcare professionals for vaccine-related information while considering advice from their social circles, including friends, neighbors,

colleagues, and family members. However, as decision-making progressed, the influence of these social networks intensified, with mothers actively seeking advice and firsthand experiences from peers, online platforms, and community groups.

In the first round of interviews, healthcare professionals were the most frequently mentioned source of information (10 mentions), followed by social circles (18 mentions), online platforms (14 mentions), WeChat groups (5 mentions), and family discussions (7 mentions). At this stage, mothers primarily relied on professional advice while passively observing vaccination behaviors within their social networks. Although some sought recommendations from friends or family, their trust in online information remained low, indicating a cautious approach to decision-making.

By the second round, mothers' reliance on social networks and peer experiences increased significantly. Mentions of healthcare professionals doubled (23 mentions), while discussions within social circles surged to 27 mentions. Online information became more relevant (22 mentions), and participation in WeChat groups and training sessions grew (13 mentions). This shift reflects an active engagement process, where mothers no longer passively received information but instead actively sought insights from their networks, cross-checking experiences and vaccine outcomes before making decisions. Spouses and family members remained influential, with a more interactive decision-making process emerging within households.

In the third round, a multi-source verification approach became evident. Mothers integrated information from healthcare professionals, peers, online platforms, and family members, demonstrating a more rationalized and evidence-based evaluation of vaccine choices. While trust in healthcare professionals remained high, social circles provided firsthand, experience-based knowledge, and online sources became an important but critically evaluated component of decision-making. Mothers weighed multiple perspectives, balancing professional

recommendations, peer insights, and personal circumstances before making final vaccination decisions.

3.2.3.1 The Role of Healthcare Professionals

Healthcare professionals have consistently played a significant role in shaping mothers' decisions regarding non-NIP vaccines. In the first round of interviews, professional advice was mentioned 10 times, highlighting their initial influence. One respondent noted:

"I tend to listen more to professionals. For example, as new mothers, we don't understand much, so we rely on hospitals to provide us with more balanced information on the pros and cons. Positive publicity helps us learn more. If you just listen to random rumors, that may not be reliable either."

By the second round, mentions of information provided by doctors increased to 23, reflecting a growing reliance on professional guidance. A participant shared:

"The hospital recommended it. Initially, I wasn't planning to vaccinate and was still hesitant."

In the third round, healthcare professionals continued to be a major reference point, particularly for vaccination schedules and adverse reaction monitoring:

"I still rely on healthcare professionals for reminders. They inform me about the timing of the next dose and let us decide whether to proceed."

3.2.3.2 Influence of Social Circles

Mothers frequently referred to the vaccination experiences of peers, including neighbors, friends, colleagues, and domestic workers. In the first round, these sources appeared 18 times:

"I ask those who have given birth before—what vaccines they got, and which ones they recommend."

This influence expanded in the second round, with 27 mentions. Discussions with peers helped shape vaccine perceptions, as one mother noted:

"At first, I hadn't decided to vaccinate and thought we couldn't afford it. But my neighbor, who also had a baby, told me that pneumonia is very common in young children."

By the third round, peer influence remained strong:

"Later, I also followed my good friends' advice. Some of them said that many vaccines are available for free. For example, the group A meningococcal vaccine (A group) is free. But when I checked on Xiaohongshu, I found that in our country, meningococcal viruses of types A and C are more common, so we chose to get the AC meningococcal vaccine."

3.2.3.3 Online Information: A Growing Yet Uncertain Influence

In the first round, online sources were mentioned 14 times, but mothers expressed concerns about reliability:

"I don't usually ask people much because very few have the exact same situation as mine. Instead, I just search on self-media platforms or Baidu, scare myself for a bit, then try to calm down, then get scared again—it's a cycle of breaking down and recovering."

By the second round, mentions of online information increased to 22, reflecting a growing dependency despite ongoing skepticism:

"I looked things up online and found that many self-paid vaccines seem to have stronger

side effects."

In the third round, reliance on digital platforms persisted:

"I once checked on Xiaohongshu and found that in our country, meningococcal viruses of types A and C are more prevalent. So, we ultimately decided to get the AC meningococcal vaccine."

Although the quantitative data indicate a significant positive correlation between obtaining vaccine information from social media and non-NIP vaccine uptake, the qualitative data reveal a more complex and dynamic pattern of use. In the first round of interviews, although mothers mentioned searching for information online, many expressed clear distrust and emotional fluctuation. This "cycle of self-induced anxiety" suggests that social media did not provide confidence but instead triggered greater uncertainty—an observation that contrasts with the quantitative findings. In the second round, mothers' use of online information increased. Some mentioned that reading claims such as "self-paid vaccines have stronger side effects" actually intensified their doubts, prompting them to seek information from multiple sources for verification. By the third round, although mothers continued to actively search for online information, they began to show stronger discernment. Social media became a preliminary information source, which was then cross-validated through authoritative channels such as healthcare professionals and official platforms. Over time, mothers developed an information-processing strategy of "initial search – critical filtering – final decision."

This process helps explain the apparent contradiction between the quantitative and qualitative results. On one hand, frequent engagement with social media does provide mothers with access to more vaccine information, which correlates with a higher likelihood of vaccination. On the other hand, this behavior is not driven by blind trust in social media content, but rather by

mothers' active information screening and risk management in the face of complex and often contradictory sources. Platforms like Xiaohongshu, Baidu, and TikTok are typically used as "first filters," while official platforms such as Xiaodoumiao, YumiaoTong, and direct consultation with doctors are relied upon for final validation. This critical usage pattern helps reconcile the seemingly conflicting findings—while social media may facilitate vaccination behavior quantitatively, it also coexists with hesitation and concern as reflected in the qualitative data.

3.2.3.4 The Role of Family in Decision-Making

Spouses and family members played a crucial role in vaccination choices. In the first round, family influence was mentioned seven times:

"My husband actually plays a role. He suggested that I shouldn't give the baby too many vaccines. Based on what he knows, not all vaccines are necessary. For my second child, I may take his opinion into account more."

By the second round, family influence grew to 10 mentions:

"He gets involved too—he asks his colleagues and friends, then ultimately decides that vaccination is the right choice."

The third round reaffirmed the impact of family perspectives:

"My cousin's child has received almost all the vaccines. But there are also families who don't vaccinate—my husband's cousin, for example, refuses to pay for vaccines. His child is now over one year old, but they had a suspected case of pneumonia and had to visit the hospital multiple times. It has been a bit stressful for them, though it's unclear whether the lack of vaccination was the cause."

3.2.3.5 Mothers' Information Processing and Vaccination Attitudes

Early in the decision-making process, mothers primarily trusted healthcare professionals, with little reliance on alternative sources. Over time, their approach became more multidimensional, integrating information from multiple perspectives.

"I actually trust doctors more because they have more selective medical knowledge. I believe professionals provide the best advice, so I tend to follow their recommendations."

Vaccination attitudes evolved accordingly. In the first round, skepticism was prevalent:

"I think it's okay to be skeptical sometimes. Vaccination is like using diapers—what works for one person may not work for another. Just because a vaccine is imported doesn't mean it's the best, and domestic vaccines aren't necessarily inferior. We are still considering whether to get the third dose next month. We've had two doses already, but we are still observing and deciding."

By the second round, some mothers showed a shift toward acceptance:

"I feel that as long as there are no side effects, I don't need to worry about effectiveness. There's no point in overthinking it. Since the vaccine is available and people are getting it, why worry about its safety or efficacy? The only real concern is whether the child will have an adverse reaction after vaccination, just like with MMR. That's what really matters."

In the third round, rational decision-making became more common:

"I think it's best to follow my own judgment. The final decision is mine. I can take into account what others say, but ultimately, I will decide based on my own child's situation."

3.2.4 Shifting Patterns of Social Network Influence

The influence of social networks on mothers' vaccination decisions evolved through distinct phases, reflecting shifts in information-seeking behavior and decision-making strategies. Initially, mothers engaged in observational learning, passively absorbing vaccine-related information from their surroundings. As they progressed in their decision-making, they actively sought insights from peers, family members, and online platforms, demonstrating a growing preference for experience-based knowledge. This transition from passive observation to active engagement marked a critical shift in how social interactions shaped their vaccination choices.

While healthcare professionals remained a trusted source throughout the decision-making process, mothers gradually expanded their evaluation framework to include multiple sources. Early on, they relied predominantly on medical professionals' recommendations, but as they encountered diverse perspectives from friends, community members, and digital platforms, they adopted a multi-source evaluation approach. Rather than solely accepting medical authority, they began balancing expert opinions with peer experiences to make more comprehensive vaccination decisions.

Online platforms, initially met with skepticism and caution, gained prominence as mothers learned to critically assess and filter information. While concerns about misinformation persisted, digital sources such as Xiaohongshu, WeChat groups, and parenting forums became increasingly relevant in shaping perceptions. Notably, official health platforms such as Xiaodoumiao and Yumiao Tong—despite being part of the online ecosystem—were seen as trustworthy due to their institutional credibility. Many mothers turned to these platforms for accurate vaccine schedules, side effect explanations, and professional advice. When confronted with conflicting messages on social media, mothers often sought verification through these official channels, using them as anchors to navigate the sea of fragmented or misleading content. The transition from distrust to

selective reliance underscores the growing role of digital information in vaccine decision-making, with mothers strategically differentiating between peer-driven content and professionally endorsed guidance.

Family influence remained a stable yet evolving factor throughout the process. Spouses, extended family members, and household discussions played a crucial role in shaping mothers' attitudes toward vaccination. Initially, these interactions were secondary to professional advice, but as decision-making deepened, family dynamics and collective decision-making became more pronounced. Emotional reassurance, financial considerations, and shared experiences within the family contributed to a more nuanced and context-dependent approach to vaccine acceptance or hesitancy.

These shifting patterns illustrate a broader transformation in how mothers navigate vaccination decisions. Over time, they moved from a single-source, authority-driven approach to a diverse, integrated evaluation process, ultimately demonstrating a more rationalized and strategic decision-making framework that accounted for both expert knowledge and social influences.

3.2.5 Analysis of Results from Three Rounds of Interviews with Districts

This study utilizes matrix coding to explore the differences in coding between respondents from Dazu District and Yuzhong District regarding two core categories: sources of vaccine-related information and mothers' information acceptance and vaccination attitudes. The coding results are as follows.

Table8 Comparison of coding results for vaccine-related information sources

	First Round		Second Round		Third Round	
	DaZu	YuZhong	DaZu	YuZhong	DaZu	YuZhong
Introduction of healthcare workers	4	9	13	19	5	10
People around you pick up the situation	8	23	12	22	18	24

Network information impact	15	11	12	16	11	14
WeChat groups and related training courses	0	8	4	11	2	7
Communication between spouses and family members	3	13	2	11	4	6

Table9 Comparison of coding results for mothers' information acceptance and vaccination attitudes

	First Round		Second Round		Third Round	
	DaZu	YuZhong	DaZu	YuZhong	DaZu	YuZhong
Information reception	18	17	31	35	31	41
Vaccination attitude	9	6	8	5	19	25

Regarding vaccine-related information sources, respondents in Yuzhong District relied more on healthcare professionals and were more likely to obtain information from their social circles, WeChat groups, and training courses. They also engaged in more discussions with their spouses and family members, although Dazu District showed a catching-up trend in the third round of interviews. The influence of online information was similar in both regions.

In terms of mothers' information acceptance and vaccination attitudes, Yuzhong District mothers demonstrated a higher acceptance of vaccine information. Initially, mothers in Dazu District were more proactive about vaccination, but over time, the vaccination attitude among Yuzhong District mothers increased significantly, surpassing that of Dazu District.

4. Discussion

This study emphasizes the key role of social networks in mothers' vaccination decisions, with frequent discussions with spouses, family, friends, and colleagues positively influencing vaccination behavior. The quality of information outweighs quantity, especially as low-trust platforms complicate decision-making. Healthcare professionals' advice significantly impacts vaccination rates, though mothers also consider family, friends, and networks. As mothers gain more information, their attitudes evolve, moving from skepticism to more rational assessments of vaccines. Improving information quality and communication can increase vaccination acceptance. However, the potential biases, such as leading questions and social desirability bias, limit generalizability. Future research should expand the sample, combine other data collection methods, and explore the roles of different social network types in decision-making.

Beyond the individual influence of social networks, this study also highlights the intersection between social connectivity and socioeconomic status in shaping maternal vaccine decision-making. Mothers from higher-income households or with higher levels of education demonstrated greater ability to access and critically evaluate vaccine-related information within their networks. In contrast, mothers in lower-income settings often relied on a narrower range of sources, frequently limited to family members or local acquaintances, and were more susceptible to vaccine misinformation or lack of information altogether. This disparity suggests that the influence of social networks is not uniform but is mediated by socioeconomic resources, which determine both the breadth and the credibility of accessible information. In particular, mothers with stronger digital literacy and economic flexibility were more likely to cross-verify information from peers and online channels with official sources such as Xiaodoumiao or Yumiaotong, thereby making more informed and confident decisions. These findings underscore

the need for targeted public health strategies that account for the compounded effects of social and economic positioning, especially in rural or underserved communities.

5. Conclusion

This study integrates quantitative and qualitative analyses to systematically explore the impact of social networks, family factors, maternal individual characteristics, and regional differences on the uptake of non-National Immunization Program (non-NIP) vaccines for newborns in Chongqing. The research aims to reveal how social network interactions shape mothers' vaccination decisions and to provide scientific evidence for the formulation of public health policies.

The comprehensive analysis indicates that social network interactions, the influence of spouses and social network and the social media are key factors influencing vaccination behavior. In contrast, social network breadth and regional differences have relatively weaker effects on vaccination decisions in certain contexts but should not be overlooked.

Both quantitative and qualitative analyses show that the quality of information is more important than the number of information channels. Frequent discussions with spouses, family, friends, and media positively impact vaccination behavior, but social network breadth has no significant effect. Mothers prioritize credible sources, relying on healthcare professionals initially and later seeking more diverse information, though they remain cautious about online content. Trust is key in shaping vaccination decisions.

Quantitative analysis shows that a spouse's importance significantly impacts vaccination behavior, with higher vaccination rates in the mother's social circle increasing the likelihood of vaccination. Qualitative analysis reveals that mothers value their spouse's informational and emotional support, reducing decision-making pressure. The vaccination experiences of friends and peers strengthen confidence and willingness to vaccinate, highlighting peer effects and social norms. Spouses provide both informational support and emotional security, while social circles influence decisions through social comparison and imitation, driving vaccination behavior.

Mothers with higher education are more willing to vaccinate their children. Quantitative results show that higher education (especially junior college or higher) and maternal age are positively linked to vaccination behavior, while higher economic status also increases vaccination likelihood, though not always significantly. Educated mothers are better at evaluating scientific information, and wealthier families focus more on vaccine effectiveness and safety rather than cost. Higher health literacy in educated mothers leads to more rational decisions, while economic status affects sensitivity to vaccine prices and prioritizes long-term benefits.This finding was supported by both quantitative and qualitative data.

Quantitative analysis shows a positive association between social media use and non-NIP vaccine uptake, while qualitative findings offer a more nuanced explanation. Survey results indicate that mothers who frequently access vaccine-related information online are more likely to vaccinate their children, which may reflect that those with higher levels of social network engagement are generally more proactive in making health-related decisions. However, interviews revealed that mothers' actual experiences with social media were more complex. Many mentioned that platforms like Xiaohongshu and TikTok often contained conflicting, exaggerated, or commercially driven content, which sometimes led to confusion or hesitation about vaccination. In contrast, platforms such as Xiaodoumiao and Yumiaotong, although also online, were perceived as more trustworthy due to their official affiliation and professional content. Most mothers did not blindly accept information from social media but preferred to cross-check it—comparing informal sources with official platforms or consulting healthcare providers directly. This behavior helps explain the apparent contradiction between the quantitative and qualitative findings: while social media use may be associated with vaccine uptake, this link depends on mothers' ability to critically filter information and rely on credible sources to make informed decisions.

The regional differences reflect the problems of urban-rural development imbalance and unequal distribution of health resources. In Dazu District, shortcomings in medical services, health education, and information dissemination directly impact mothers' willingness and behavior regarding vaccination.

Appendix A

Phase 1: Social Network-Related Questions

1. Did you receive any recommendations from friends, family members, or other acquaintances about paid vaccines?
   A. Yes
   B. No
2. Through which of the following channels have you obtained information about paid vaccines? (Multiple choice)
   A. Social media (e.g., TikTok, Xiaohongshu, Weibo)
   B. Healthcare professionals at the vaccination site or promotional materials
   C. WeChat groups, text messages, or other notifications from the vaccination site
   D. Healthcare professionals (e.g., doctors, pregnancy classes, prenatal classes, lectures)
   E. Relatives, friends, colleagues, or other acquaintances (both online and offline communication)
   F. Public lectures and awareness campaigns
   G. Schools (kindergarten teachers or other educators)
3. Before this vaccination appointment, did you consult or discuss any paid vaccines with anyone (e.g., family members, friends, or acquaintances)?
   A. Yes
   B. No

Phase 2: Social Network-Related Questions

1. What was your main reason for vaccinating your child with a paid vaccine? (Multiple choice)
   A. Because the doctor recommended it
   B. Because friends or family members recommended it

C. Because I know of a child who contracted a disease that this vaccine prevents

D. Because I am worried about my child's risk of infection

E. Because vaccines, in general, are beneficial

F. Because this vaccine happened to be available at the vaccination site

G. Because people I know have also vaccinated their children

H. Because if my child gets infected, I will regret not vaccinating

I. Other (please specify)

2. In the past two months, have you sought information about paid vaccines through the following channels?

   (Yes/No for each)

   A. Social media (e.g., TikTok, Xiaohongshu, Weibo)

   B. Healthcare professionals at the vaccination site or promotional materials

   C. WeChat groups, text messages, or other notifications from the vaccination site

   D. Healthcare professionals (e.g., doctors, pregnancy classes, prenatal classes, lectures)

   E. Relatives, friends, colleagues, or other acquaintances (both online and offline communication)

   F. Public lectures and awareness campaigns

   G. Schools (kindergarten teachers or other educators)

3. Before this vaccination appointment, did you consult or discuss any paid vaccines with anyone (e.g., family members, friends, or acquaintances)?

   A. Yes

   B. No

Phase 3: Social Network-Related Questions

1. In your social circle, how many children have received the following paid vaccines?

(Options: All children (>90%), Most children (>50%), Some children (30%-50%), Only a few. (<30%), None (0%), I haven't asked, Not sure)

A. 13-valent pneumococcal conjugate vaccine (PCV13)

B. Quadrivalent or pentavalent vaccine

C. Hand, foot, and mouth disease (HFMD) vaccine

D. Meningococcal vaccine

2. Overall, how frequently have you communicated, consulted, or gathered information about paid vaccines through the following channels?

(Options: Never, Rarely, Occasionally, Often, Always)

A. My spouse

B. Other family members

C. Relatives, friends, colleagues

D. Other acquaintances (both online and offline)

E. Healthcare professionals at the vaccination site

F. Social media (e.g., TikTok, Xiaohongshu, Weibo, WeChat Moments)

3. Please list the top three channels that most influenced your decision (or non-decision) regarding paid vaccines. (Only list the relationship, select by number)

A. Spouse

B. Other family members

C. Relatives, friends, colleagues

D. Other acquaintances

E. Doctors or healthcare professionals at the vaccination site

F. Social media platforms

Appendix B

TableB.1 Interview open coding table

Category	Initial concept	Interview materials
A1 Suggestions from medical staff	a1Doctor told me that it was necessary to call. /a2 The pediatrician said vaccination was unnecessary.	Then, anyway, the hospital said to call me. If I was given an option, for example, if he said how this is better, I would definitely choose this (the “better” vaccine recommended by the hospital). If I don't choose it, I will call this (originally written). （a1）
A2 Medical staff introduces relevant information.	a3 Ask the nurse for advice. /a4 Hospital official information	Therefore, we will still refer to the official, hospital and friends' experiences. (a4)
A3 Vaccination situation of neighbors	a5 neighbors are mostly vaccinated free of charge.	Then the neighbors next door asked them if they had to ask those questions, but they still had some, and most of them should still have paid more. More free, more free taxis, more free taxis or less taxis anyway, it's all like you stop playing after one or two injections, that's all. Then they all stopped playing. (a5)
A4 information exchange among colleagues	a6 Ask an experienced colleague	Anyway, ask these colleagues around you. Look what their children have hit. (a6)
A5 Information exchange among friends	a7 Feedback on side effects after vaccination /a8 Ask if there are side effects /a9 Ask if vaccination is useful.	Then a lot of friends, so they had problems (friends and children were vaccinated at their own expense, but it was a problem, which meant a side effect). (a7)
A6 The communication between treasure mothers	a10 Mothers share experiences with each other.	Many pregnant mothers have not said these things in it, saying that 5-in-1 may be to make their children suffer less crimes and losses, because every time they get sick, their children may get less injuries. For example, having a fever is the psychology of being a mother's glass mentality. If I would rather have fewer injections, I would definitely like to have fewer injections and less risk of slapping. If I take one injection like this, I will have a fever, and I will be heartbroken even if I take eight shots. (a10)
A7 recommended by domestic	a11 Lunar New Year recommends vaccines that must be vaccinated.	First of all, it must be the first month of our family, and then she will tell you more or less about it. She said that first, the vaccine was given free of charge by the state, and then we gave it free of charge by the state. Then, if you need it, you must import it. It

workers.		seems to mean importing it. It is imported and domestic, so you need to choose it yourself. However, these (recommended by the vaccine) must be played. (a11)
A8 network information source	a12 Baidu, Zhihu and other network platforms /a13 refer to Tik Tok, Xiaohongshu and other information from the media.	Right, what's like searching Baidu? Anyway, ask that thing and have a look. (a12)
A9 Main contents of network information	a14 Negative reports of related news/popularization of /a15 vaccine information	I usually ask others not much, because few people have the same situation as you. Just look up this kind of self-media Baidu, and then scare yourself, and then think that it may not be so powerful, and then scare yourself. The process of collapse and self-healing. (a14)
A10 Mothers' Group	a16 vaccine information exchange and sharing	Other channels also know something about the treasure mom group, and he will share it with you. For example, the report sends links to it, and it has good things. It is not that others say that some of his platforms have screenshots or share a comprehensive information collection platform. This is the case. (a16)
A11 Pregnancy education center	a17 teacher explains relevant knowledge.	It has all kinds of courses, as well as manual courses. It is different every day, so you can choose to register according to your hobbies. He has had such classes as insurance and vaccines before. (a17)
A12 Community preventive health care group	a18 Consulting vaccination related information	You can see it, but most of them don't know anything about taking care of children, and there are very few words about vaccination. There is a baby mother in front, and one is the big rash that grows on the baby. I just asked, there were mainly some consultations, or when I could call and when I couldn't, and whether a pediatrician was here this morning, mainly these. (a18)
A13 Spouse's recommend ation	a19 What Dad learned from the Internet /a20 Dad communicated with experienced friends.	Even the information obtained by my father is online, depending on what is said on the internet that I have to play at my own expense. (a19)
A14 Professiona l opinions of family members	a21 family are doctors.	Then listen to our sister-in-law. She works in a 3A hospital, so she said it was not necessary to take a taxi. Her (child) didn't take a taxi, so let's not take a taxi. (a21)
A15 Influence of spouse and family members	a22 Discuss the decision with your spouse /a23 Less participation of your elders /a24 Discuss the decision with your elders.	Because we discussed this problem before, just saying that we should make a decision, or choose which two or which one, and fight at our own expense. (a22)
A16 Comprehen sive considerati on of the surrounding	a25 includes vaccination status of neighbors, friends and family.	Actually, I don't quite understand. I did consult a lot of people, my sister and my colleagues. (a25)

people's situation		
A17 Acceptance of network information	a26 doesn't inquire about network information, specially /a27 has low trust.	Just look at it when you are bored. When you are bored, you will specially look at the children's vaccination. （a26）
A18 Information Acceptance of Medical Staff	a28 Medical staff information is authoritative.	In fact, I trust doctors, because for example, he has good selectivity in the same kind of medical treatment, and then because I think a professional person may say the best, I will listen to his advice. （a28）
A19 Accredited vaccination of Class II vaccine	a29 recognizes self-funded vaccination.	Because but I also said online, I also saw what I saw online with me, but each has its own advantages, but the benefits at my own expense are still more. I also searched online. (a29)
A20 Not recognize the second-class vaccine.	a30 thinks that self-funded vaccine is unnecessary /a31 suspects that self-funded vaccine is harmful.	Anyway, I think the original vaccine is also a virus thiamine, right? Because I don't like it very much, like some dolls with poor health who are vaccinated and those who are allergic, I generally believe in the country, and I will fight if the country says so. (a31)
A21 Vaccination has no preference	a32 has no preference for vaccination.	Do you have a preference for importing or not importing new vaccines or old vaccines? I don't think it matters. Never mind, this has nothing to do with it. (a32)

TableB.2 Axial coding table

Main category	Category	Frequency	Reference points
Presentation by healthcare professionals	A1 Advice from healthcare professionals	6	9
	A2 Presentation of relevant information by healthcare professionals	4	4
Inoculation of peripherals	A3 Neighbourhood inoculation	1	2
	A4 Exchange of information among colleagues	3	3
	A5 Exchange of information among friends	7	16
	A6 Exchange between baby mums	7	12
	A7 Domestic Staff Recommendations	1	1
Network information impact	A8 Network Information Sources	14	27
	A9 Network Information Main Content	3	6
WeChat and related training sessions	A10 Mamas and Babies Group	1	2
	A11 Pregnancy Education Centre	2	3
	A12 Community Preventive Health Cluster	2	3
Communication between spouses and family members	A13 Spouse's recommendation	4	13
	A14 Professional advice from family members	3	4
Acceptance of	A15 Influence of spouses and family members	8	13

information	A16 The situation of the surrounding people is considered in a comprehensive manner	5	5
	A17 Network information reception	4	5
	A18 Reception of information by healthcare professionals	10	12
vaccination attitude	A19 Accreditation of Vaccination Category II	2	4
	A20 does not recognize vaccination with Class II vaccines	6	10
	A21 No preference for vaccination	1	1

TableB.3 Core coding table

Core categories	Primary category
Sources of vaccine-related information	Referrals from healthcare professionals/inoculation of people around them/influence of internet information/WeChat groups and related training courses/communication between spouses and family members
Mothers' information acceptance and vaccination attitudes	Information acceptance/attitude towards vaccination

TableB.4 Saturation assessment – round 1

Interview participants	Code count	Core Categories	Number of shared core categories with previous participants	Number of newly emerged core categories	Number of core categories already emerged
T1-T24	462	2			2
T25	22	2	2	0	2
T26	14	2	2	0	2
T27	16	2	2	0	2
T28	24	2	2	0	2
T29	25	2	2	0	2
T30	14	2	2	0	2
T31	16	2	2	0	2
T32	27	2	2	0	2
T33	23	2	2	0	2

TableB.5 Saturation assessment – round 2

Interview participants	Code count	Core Categories	Number of shared core categories with previous participants	Number of newly emerged core categories	Number of core categories already emerged
T1-T24	462	2			2
T25	22	2	2	0	2

T26	14	2	2	0	2
T27	16	2	2	0	2
T28	24	2	2	0	2
T29	25	2	2	0	2
T30	14	2	2	0	2
T31	16	2	2	0	2
T32	27	2	2	0	2
T33	23	2	2	0	2

TableB.6 Saturation assessment – round 3

Interview participants	Code count	Core Categories	Number of shared core categories with previous participants	Number of newly emerged core categories	Number of core categories already emerged
T1-T22	457	2			2
T23	23	2	2	0	2
T24	22	2	2	0	2
T25	17	2	2	0	2
T26	18	2	2	0	2
T27	23	2	2	0	2
T28	22	2	2	0	2
T29	15	2	2	0	2
T30	14	2	2	0	2

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