



Understanding medical students' practices and perceptions towards vaccination in China: A qualitative study in a medical university

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ABSTRACT

The qualitative study aims to understand and conceptualize Chinese medical students' practices and perceptions towards vaccination. Focus groups ($n = 5$) were conducted through convenience sampling in a medical university in October 2016 in Anhui, China. Two years later, 6 participants among them were follow-up interviewed. All the interviews were audio-recorded, then transcribed verbatim, and analyzed using constant comparative method. Opinions of 22 participants (13 females, 9 males) were collected. Results revealed that hepatitis B vaccination was discussed the most frequently, and most of participants were vaccinated against (or had documented immunity to) hepatitis B before or during their clinical internship. None of the participants reported other vaccines uptake. Three dimensions of themes were identified: (i) at individual level, the factor "feeling less infection risk" might strengthen their perceived barriers. The factors "laziness" and "fluke mind" would be used to rationalize their inactive practices about vaccination; (ii) at social level, themes involved "inactive organizational behaviors", "suggestions from people around", and "social norms". Decision-making of medical students' vaccination was more relying on themselves and influenced more by their classmates before or during their internship, rather than being influenced more by their families/universities as before. (iii) at professional level, there are two contradictions about the participants' behaviors and attitudes. One is that they may have inappropriate behaviors because of their lack of knowledge, but sometimes they seem too satisfied about their medical knowledge to vaccination. The other is that there are both vigilance response and desensitization to occupational infection risk. It is suggested that efforts should be strengthened to spread scientific knowledge of infectious diseases and immunization as long as medical students enter the university. Publicity and organizational activities should be strengthened, and related researches should be carried out by the government or scholars.

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1. Introduction

Health-care personnel (HCP) may be at high risk for exposure to vaccine-preventable diseases (VPD) through contact with a variety of infectious agents, and this risk also constitutes a source of infection for other people such as susceptible patients [1,2]. Health-care

students, as a specific subgroup of HCP, also face a similar or even higher risk of VPD infection [2–7], due to lack of clinical experiences and skills [2,3]. Since they are future health-care workers, their attitudes and practices towards vaccination will affect patients' attitudes and practices towards vaccination [6,8]. Improving the vaccination rate is the most effective way to protect patients and medical staff against diseases targeted by vaccines in the hospital environment [1].

HCP of the United States are required to be immune to VPDs including hepatitis B, influenza, tetanus-diphtheria, measles-mumps-rubella (MMR), and varicella [1]. Health-care students are required to show proof of immunization against these diseases [1,7]. In some European countries, HCP who refuse mandatory

Abbreviations: HCP, Health-care personnel; VPD, vaccine-preventable diseases; HBV, hepatitis B virus; HepB, hepatitis B vaccine; HBIG, hepatitis B immunoglobulin; MMR, measles-mumps-rubella.

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vaccination may be transferred to another position with low infection risk or no direct patient contact, or may face a fine [2].

At present, relevant vaccination strategies for HCP are not yet active in China [9]. Centers for Disease Control and Prevention (CDC) in China explicitly recommends HCP to receive influenza vaccine. HCP receiving influenza vaccine and other vaccines are set as type 2 vaccine which is uninvolved in the National Expanded Program on Immunization (EPI) in China. Type 2 vaccine is under voluntary and at one's own expense, always with lower uptake rate, while vaccine in EPI is compulsory and free for target infants and children with a coverage rate of up to 90% [9]. Hepatitis B vaccine (HepB) was integrated into EPI in 2002, and EPI incorporated measles, mumps and rubella in 2008. Moreover, varicella has not yet been involved in EPI. Participants in this study were born in 1995–1997. Nowadays medical students in China may have an insufficient childhood vaccine uptake. Although HepB catch up campaign was conducted in 2009–2011 for children <15 years of age who were born during 1994–2001, and about 68 million children were vaccinated with HepB [10], latest studies demonstrated medical students or younger HCP in China were not yet vaccinated adequately. Data from one of medical universities in Nanning City in China showed a ≥ 3 -dose rate of 50.12% among medical students [11]. Similarly, data from three provinces of China showed a ≥ 3 -dose coverage of 59.70% among HCP aged 25–29 years [12]. In addition, testing for antibody to HBsAg (Anti-HBs) in university entrance-health-check was abolished in 2010 because of the campaign of anti discrimination against people with hepatitis B virus (HBV). Therefore university students nowadays have no idea about whether they are immune to HBV or not, which may form an obstacle to their vaccination against hepatitis B. The measles supplementary immunization activity (SIA) have been implemented since 2010, however measles outbreaks continue occur in universities or hospitals in China [13–15].

Studies aim to probe medical students' knowledge level and attitudes regarding vaccination in different countries are in their infancy [5,8,16]. Knowledge on this topic from China is also rather limited. To fill this gap, the present study used qualitative research methods, including focus group interviews (FGIs) and in-depth interviews (IDIs), to explore and understand the practices and perceptions about vaccination among Chinese medical students.

2. Methodology

2.1. Participants and setting

This study used convenience sampling to recruit 22 junior (the third year) students (13 females, and 9 males; average age 20.9 years) majoring in clinical medicine at a medical university in Anhui, China, to form 5 focus groups, and conducted 5 FGIs in October 2016. FGI is a highly efficient method of collecting data [17], and about 90% of themes can be discoverable within three to six focus groups [18].

About two years later, when FGI participants were in the fifth year and commenced their clinical internship, we conducted follow-up IDIs with 6 (3 females, and 3 males) of 22 previous FGIs participants, to provide a deeper insight into participants' practices and perceptions towards vaccination at their later stage of university.

The socio-economic status in Anhui is mid-range based on comparisons of disposable income level with that of other provinces in China. In 2017, the per capita annual disposable income in Anhui Province was 31640 RMB yuan, and 12758 RMB yuan in rural area, respectively (1 US\$ = 6.71 RMB yuan, Feb. 25, 2019) [19]. At present, there are approximate 8000 undergraduates in the medical university the study located. More than one half of them major

in clinical medicine. Clinical medicine students generally commence their clinical internships in the fifth year in this university.

2.2. Data collection

Semi-structure interview guides were applied in FGIs and IDIs to remain discussions and talks within the scope of the study aims. The FGI guide was drafted by a researcher (WL) trained in qualitative research and revised by a practitioner (ZX) from China National CDC. FGIs were conducted by WL. At the request of recruited students, FGIs were conducted in their dormitories. Male and female dormitories in this university were generally prohibited from entering of opposite gender students, so FGIs included 2 male focus groups and 3 female focus groups, and 4–5 students were involved in each group. Each group was interviewed and discussed for about 40 minutes. The purpose of the study was fully explained by the moderator, and written informed consents to take part in the study and to be audio-recorded were obtained from the participants prior to each FGI. And the participants were also told that their talks in interviews would have no effect on any future evaluations by the university and their identities were assured of anonymity. The main contents of the interviews include: (1) knowledge of vaccines and VPD; (2) perceptions and practices towards vaccination; (3) factors influencing vaccination intentions and decisions; (4) suggestions and opinions on medical students' vaccination.

The IDI guide was adjusted according to the results of FGIs, and paid more attention to vaccination characteristics among medical students, and the relationship between medical students' study experience and their vaccination behaviors and attitudes. In addition to interview outlines in FGIs, WL and ZX decided to add the following interview outlines: (1) As medical students, do you think there is a special need for vaccination during university? (2) Do your medical- students' experiences and occupational environment like health-care setting affect your vaccination practices and perceptions?; (3) Do you have the awareness to protect other people like the patients through vaccination? WL carried out follow-up IDIs with 6 students one by one in a quiet, comfortable and private environment. Each IDI lasted for about 35–83 minutes.

The moderator continued to encourage the participants to express their experiences, views and opinions around vaccination until no new issues arose, according to grounded theory approach. The moderator did not comment on participants' performances during interview process.

2.3. Data analysis

Data analysis and data collection were conducted simultaneously, which facilitated mid-course corrections and further investigation. Audio-recorded sessions, using Digital Voice Recorders (AIGO R5570 and AIGO 6611), were fully transcribed verbatim by ZS within two weeks after FGIs and IDIs. Each group and participant was assigned an anonymized identifier like FG1 which means the first focus group, and FG1-1 which means person 1 in the first focus group. Transcripts were verified by the moderator. Data analysis used the constant comparative method with a series of codes and categories [20]. All interview transcripts were coded independently by WL and ZQ, and different points were identified, then a consensus was reached after discussion. Consistent themes were developed inductively when the coding process evolved. We paid more attention to the factors that appeared most important to medical students, rather than that seemed prevalence, though these two might be very correlated. Some of analysis results were reported in participants' own words, and some descriptive content or repeated words were removed because of constraints on word limit. Ethical approval was obtained from the Biomedical Ethics Committee, Anhui Medical University.

3. Results

3.1. Participants characteristics and general practices

The opinions of 22 participants (13 females) were collected and compiled. Their age range was about 19–23 years in 2016 when FGIs were conducted. In initial FGIs, most participants were not aware of vaccination. Some participants thought that they had received all the required vaccines in childhood, so they did not need to be vaccinated after entering university. Some participants said they did not remember which vaccines they had received before university and did not know which vaccines were needed now. The participants described this state as “confused”.

Hepatitis B vaccination was discussed the most frequently (see below for detailed discussion). 3 participants (1 male and 2 females) had been vaccinated against hepatitis B since entering university. Other participants did not receive HepB and did not test Anti-HBs. The participants also expressed their attitudes about influenza vaccine under the moderator’s guide. One FGI actively talked about rabies vaccine for human use, because they thought medical students were at risk of being bitten or scratched in animal experiments. No participants received any other vaccines.

In IDIs more than 2 years later, HepB still received the most attentions among the participants. Among 6 participants in IDIs, FG1-1 forgot to receive the third dose of HepB after FGIs, before which he had received two doses. And FG1-1 received hepatitis B immunoglobulin (HBIG) after hand being pricked by needle once during his internship, but he did not consider to receive HepB again after this emergency. Another 4 students, FG1-3, FG3-3, FG4-2, FG5-4 tested anti-HBs before or during their internship. FG4-2 and FG5-4 found they were immune to HBV. FG1-3 and FG3-3 went to get HepB when seronegative was found. FG2-1 had a strong intention to test Anti-HBs and might decide whether to receive vaccine or not based on test result. A summary of partici-

pant demographics, including their vaccination practices after entering university can be seen in Table 1.

3.2. Medical students’ perceptions about vaccination

The study indicate three dimensions of themes about medical students’ vaccination: themes at individual, social and professional level. It should be noted that factors in these three dimensions did not existed in isolation, but had mutually overlapping areas. For example, factors in individual level such as perceived infection risk might be influenced by their professional knowledge, and factors in social level such as organizational behaviors were also related to individual’s understanding about the professional background of medical university. Thematic framework with related factors can be seen in Fig. 1.

3.2.1. Results from FGIs

i. Individual level

The themes of “perceived risk”, “perceived effect”, “perceived barriers”, and themes about human nature like “laziness” and “flake mind” were involved in individual level.

Perceived risk: feeling less/vague infection risk or feeling less severity

In FGIs, many participants said they felt less infection risk, and therefore they did not want to get vaccinated. Some participants thought that “infectious diseases are not popular, people around us seem healthy (FG1-1)”, and “The school cafeteria is safe and poses little risk of spreading diseases” (FG2-3). If they “exercise regularly, the likelihood of getting a disease is low (FG2-2)”.

When the moderator asked participants whether they would pay special attention to disease prevention as medical student, some participants answered this question from the perspective of diet or exercise, rather than vaccination.

Table 1

Participants demographics and their vaccination practices after entering university.

Participant identifier	Gender	Age	Vaccination practices after entering university (results from FGIs)	Vaccination practices after entering university (results from follow-up IDIs)
FG1-1	Male	20	Two doses of hepatitis B vaccine were received, and the third dose was supposed to vaccinate 2 months after FGIs	Forgetting receive the third dose after FGIs. Hepatitis B immunoglobulin was received after hand needlestick injury during clinical internship
FG1-2	Male	21	No vaccination	
FG1-3	Male	21	No vaccination	Receiving hepatitis B vaccine during internship because seronegative of anti-HBs was found
FG1-4	Male	22	No vaccination	
FG2-1	Male	19	No vaccination	No vaccination until now, but has strong intention to test anti-HBs, and plan to receive hepatitis B vaccine before entering department of infectious diseases during internship
FG2-2	Male	21	No vaccination	
FG2-3	Male	21	No vaccination	
FG2-4	Male	23	No vaccination	
FG2-5	Male	22	Have been vaccinated against hepatitis B	
FG3-1	Female	21	No vaccination	
FG3-2	Female	21	Have been vaccinated against hepatitis B	
FG3-3	Female	21	No vaccination	Receiving hepatitis B vaccine during internship because seronegative of anti-HBs was found
FG3-4	Female	20	No vaccination	
FG4-1	Female	20	No vaccination	
FG4-2	Female	21	No vaccination	Seropositive of anti-HBs was found, so no hepatitis B vaccine was vaccinated.
FG4-3	Female	21	No vaccination	
FG4-4	Female	21	No vaccination	
FG5-1	Female	20	No vaccination	
FG5-2	Female	21	No vaccination	
FG5-3	Female	21	No vaccination	
FG5-4	Female	21	No vaccination	Seropositive of anti-HBs was found, so no hepatitis B vaccine was vaccinated.
FG5-5	Female	20	No vaccination	

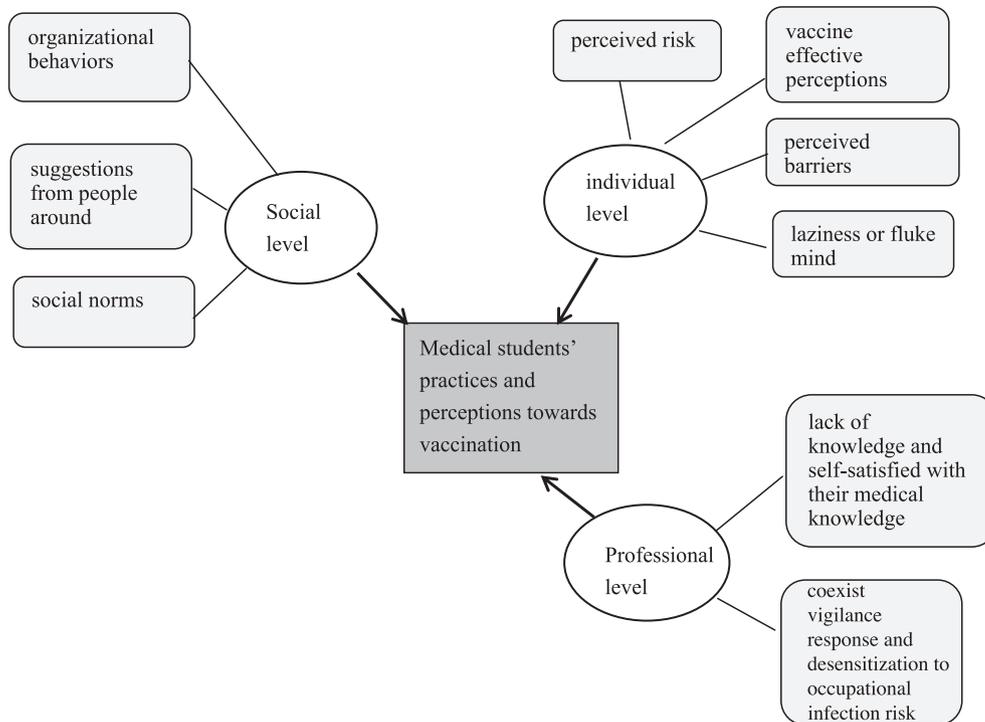


Fig. 1. Conceptualizing China medical students' practices and perceptions about vaccination.

Moderator: You are medical students, so would you be more aware of infection risk and take some preventive actions?

FG2-2: Well, I pay more attention to my diet. Since last year, I have not eaten salted vegetables. People around this area like to eat that food, but it is too salty to their health. And I knew from my teacher of Preventive Health Care that soy milk is also not good for health. It has estrogen-like effect, leading to gynecomastia, irregular menstruation in women and so on. After class that day, I told my family members it was better not to drink soy milk.

Some participants who mentioned infection risk just considered the risk during their clinical internship in future. They perceived that it was more likely to be infected with diseases during internship.

I will get vaccinated before beginning my internship, you know we will work at the department of infectious diseases and the gastroenterology department during our internship and there's certainly a risk of contracting disease like hepatitis B. (FG2-2)
A doctor in a TV series was infected hepatitis B virus, because he stabbed himself in the hand during an operation on a patient with hepatitis B accidentally. So it shows that the probability of infecting a disease during internship was pretty high, and I plan to be vaccinated all required vaccines before internship. (FG3-2)

One group of participants discussed actively whether rabies for human use should be received when someone was scratched or bitten by rabbits or mice in their experiment. They had a vague understanding of the risk under this situation, and their teacher in charge of the experiment could not give them a definite answer when it really happened to some students around them.

FG5-1: Because we often do animal experiments, and there is potential risk of being bitten by animals.

FG5-3: DRY, a classmate in the next dormitory, was bitten by experimental mouse and vaccinated against rabies, which cost more than 2,000 yuan.

FG5-2: But last time, another classmate, XHB was bitten too, he did not get rabies vaccine for human use.

FG5-4: Yes, en, in this case, we don't know what to do. If you ask experiment instructor, he may say laboratory animals are generally cleaner, but you can get vaccinated if you are worried about that.

The risk perceptions about influenza received low attentions among the participants, because they thought influenza was not a very serious disease and they could conquer it by their own immune system or just taking some medicine. Some participant thought that "influenza is just like catching a cold (FG1-2)". Receiving influenza vaccine was regarded as unnecessary. Particularly, some students argued that conquering influenza without vaccine was more useful for healthy.

Sometimes catching influenza is not a bad thing, excessive prevention like receiving vaccine is not necessarily good. (FG3-3)

Perceived effect: differences among different vaccines

Many participants believed that most kinds of vaccine were effective and could protect against relevant infectious diseases. Many students thought that HepB was very useful, because the effectiveness of this vaccine could last a long time. Some participants called this kind of vaccine as "Big Vaccine". However, the effectiveness of influenza vaccine was considered unreliable.

I would not be vaccinated against influenza. I think it just shows some level of efficacy for flu vaccine, which means that sometimes flu vaccines do not work very well (FG1-1)

Perceived barriers: being busy, inconvenient or expensive

Perceived barriers were mentioned by all focus groups. Especially, the participants thought they were busier than non-medical students, because they had more courses to learn. We found that the time spent on vaccination, whether transportation for vaccination was convenient, whether the vaccination procedure was convenient were the major factors considered by medical students.

If the place to get the shots is far and it takes me an entire day to travel to and from it, then I don't want to go. (FG2-4)

You know we are medical students, we are busy in studying, I have no much time to think about whether, when, and where I need to receive some vaccines. Look at these books, medical students have too much to learn. (FG4-4)

Vaccine price was also frequently perceived as a barrier factor. Students in all focus groups had mentioned that vaccine price would affect their intentions to get vaccinated. Concern on vaccine side-effect was also mentioned by some medical students, though most of them argued that the probability was very low, and they would not refuse vaccination because of concern on side-effect if vaccination was necessary.

Human nature factors: laziness or fluke mind

Human nature factors like “laziness” and “fluke mind” were mentioned repeatedly. Some participants admitted that “We know that some people around us have hepatitis B, and HBV carriers may be more, but we cannot see the symptoms and do not know exactly who these people are, so we do not take it (vaccination) very seriously (FG2-2)” It seemed a typical fluke mind.

We argued that “laziness” and “fluke mind” might raise medical students’ perceived barriers. In other words, they might use words such as “inconvenient”, “being busy”, or “expensive” as an excuse for their “laziness” or “fluke mind”. As mentioned above, some participants used the words “being busy” or “inconvenient” to explain why they did not have strong intentions to vaccinate. When someone shared their vaccination experiences and showed that it was not necessary to spend much time and it was also very convenient, other participants admitted that they were lazy or had fluke mind.

FG1-2: I don't think about vaccination for hepatitis B vaccine. After all, you have to get three doses, it's very inconvenient to get vaccinated in hospital.

Moderator (ask FG1-1): You have been vaccinated for two doses of HepB since entering university, do you think whether the process of vaccination is convenient or not?

FG1-1: I think the whole process is very easy, the vaccination site is just beside our campus, in our affiliated hospital, people wait in line are not many, you don't even need to register, you only go to pay for it and get a shot, then you can go away.

FG1-3: oh, I admit that we are lazy.

FG1-3: Yes, the main reason is laziness.

FG1-2: en, The main reason is the fluke mind. It seems less risky, no one around us seems very sick. Therefore I feel there is no need to vaccinate.

ii. Social level

Inactive organizational behaviors

Medical university was seen as an organization with medical background among the participants, and they thought this kind of organization would consider whether their students should be vaccinated against VPDs or not. Individuals might think they did not need to think about vaccination, if relevant vaccination activities among medical students were inactive in their organization.

We are in a medical university which should know whether we need vaccination or not. The university has not mentioned this issue for many years, so we don't think we need it.(FG3-1)

Medical university was also considered as health-conscious community, and sanitation on campus was supposed to be better than that in other universities. The participants thought they were safe, and were not susceptible to infectious disease.

We all live on campus, I feel we are very safe. After all, medical university should pay more attention to community hygiene. (FG2-2)

Furthermore, vaccination decisions of medical students were likely to be influenced by organizational behaviors to some extent. In many participants’ opinions, if the university could play an organizational role such as sending related information, giving some lectures about vaccination or organizing them to participate in vaccine-related-activities, their intentions to vaccinate would be promoted, because it could raise their vaccination awareness and reduce the time cost. Some participants mentioned in particular the importance of vaccination reminders before their internship.

Most of us do not know which vaccine should receive in university, so if the university can carry out some publicity activity or health education, then we can acquire related information, it may help us to decide whether to be vaccinated and which vaccines to receive. (FG5-5)

There are many student associations on campus, but no association is about vaccination. If the student association can make some posters about this topic, for example informing us what vaccines may be needed recently. Only we know relevant information, we can decide whether we need to get a shot or not. (FG3-4)

I think it is necessary for the university to make a unified vaccination status investigation before our internship. (FG4-3)

Suggestions from people around

FGIs found that vaccination decisions of 3 medical students who received HepB were more or less influenced by suggestions of others around them. FG1-1’s cousin was a student in another university and one of her classmates was a HBV carrier. She told FG1-1’s parents that it was very important to be vaccinated against HBV as a medical student. The suggestion was not adopted by FG1-1 at first. Two years later, FG1-1’s friend who majored in Clinical Chemistry and Laboratory Medicine in another university gave him similar advice. Then FG1-1 went to receive two doses of HepB under above multiple suggestions from people around him, and the third dose was supposed to be vaccinated about two months after FGIs. Several members in FG2-5’s family worked in hospitals. They thought that medical students had a greater infection risk because of possible contact blood and body fluids of patients. However, FG2-5 did not respond to a primary 3-dose hepatitis B vaccine series and 2 additional doses. FG3-2’s mother took her to receive HepB after entering university, because her mother “felt that there had been a certain period of time since her(FG3-2) last vaccination, worried that she was now not immune to HBV”(FG3-2)

Social norms

Both compliant and dissident behaviors will be involved in the complicated process of socialization, and these behaviors are probably shaped by peers’ interactions [21]. The participants’ vaccination practices and perceptions might show their social situation or follow a certain social norms. In FGIs, most participants thought just a very few people got vaccinated, and the “very few” were not their social norms, so they did not follow practices of the minority. FG1-1, a monitor in their class, receiving two doses of HepB in his third year at university and told that to his roommates, but we found there was a lack of clear intention to vaccinate among these roommates. They said that it was not considered to be a common practice in their peer society.

iii. Professional level

Participants had taken some basic medicine courses such as *Anatomy, Physiology, Microbiology, Immunology* and so on. Some knowledge about vaccination was involved in these courses. For example, *Immunology* introduced the mechanism of human immunity, and *Microbiology* introduced the nature of microorganisms such as virus and bacteria. These courses might temporarily arouse

medical students' awareness about vaccination, however they would forget it soon after class.

I have considered this issue (vaccination), because one day Immunology teacher talked about related knowledge, but this awareness disappeared soon after class. (FG3-4)

Some knowledge would affect medical students' judgment on the necessity or effectiveness of vaccination. In FGIs, "influenza virus mutate easily" and "influenza vaccine has less protective effect" were repeatedly mentioned by participants. And the knowledge was from their course instructor.

There is no need to vaccinate against influenza, because influenza virus can easily mutate. the teacher of Microbiology told us about that. Most of our teachers are doctors in our affiliated hospital. First of all, unlike other viruses, DNA double strands are relatively stable. Influenza viruses are often prone to mutating. Maybe when you are just studying about them, they have mutated into something else. A small change will be another virus. (FG5-4)

3.2.2. Results from follow-up IDIs

i. Individual level

High infection risk perception

Two years after initial FGIs, the participants were in their stage of clinical practice and training. Follow-up in-depth interviews showed that medical students had a strong awareness of some infectious disease such as hepatitis B, AIDs and so on in hospital setting. Hepatitis B was still be worried most among medical students. "High HBV infection risk" had become an important theme identified in this round of interview.

Clinically, there is a very high possibility of contact with some patients with HBV. Some patients are with big HBV positive (HBsAg, HBeAg, and HbCAb test positive) and some are with small HBV positive (HBsAg, HBeAb, and HbCAb test positive), many these patients are in the ward, maybe the patient you are in charge of is this disease. (FG2-1, IDIs)

Yes, teacher, I remember you, you interviewed us (means FGIs) two years ago. At that time, few people among us received HepB. However, after entering hospital, we found a certain number of patients with HBV or HIV in our internship hospitals. Then, I went to be vaccinated against HBV. (FG3-1, IDIs)

Strong vaccination awareness against HBV

Compared with less awareness and few intentions about vaccination demonstrated in initial FGIs, in follow-up IDIs, participants showed much stronger awareness of vaccination against HepB. Among 6 students participating in the IDIs, 4 of them actively test their Anti-HBs, and those (two students) with negative antibodies were vaccinated with HepB. Another one said that he had to test Anti-HBs before entering the department of infectious disease next month. Most of participants said it was very common for medical students to test their Anti-HBs and then to receive HepB before or during their internship if seronegative was found.

Next month I'm going to the department of infectious disease. The most common patients in this department are cirrhosis patients and all kinds of hepatitis patients. So anyway, I think I have to get vaccinated as soon as possible. (FG2-1, IDIs)

Generally speaking, we will test our Anti-HBs before internships. If Anti-HBs is positive, we don't need to think about HBV infection. If it is negative, we will chose to vaccinate (hepatitis B vaccine). (FG4-2, IDIs)

Being busy: an excuse for fluke mind

During the internship, perceived barriers about vaccination among medical students were significantly reduced, such factors as "inconvenience", "price" and "concern on adverse reaction" were rarely mentioned. But "being busy" was still considered a vaccination barrier, and also seemed as an excuse for rationalizing their "laziness" and "fluke mind". For example, FG2-1 had not been vaccinated against HBV since entering internship, although he was significantly aware of the importance of HepB, and he knew in advance that he would be transferred to the department of infectious disease. He used the words "being busy" to explain this situation, but his schedule (his answer under the moderator's inquiry) showed that he still had enough free time, and he knew that the vaccination site was in his internship hospital. So "being busy" seemed an excuse. And he mentioned "fluke mind" unconsciously several times in his comments.

I always plan to receive HepB, always think about that. I know this (get vaccinated against HBV) is the right thing. But you know, we are busy, in fact, people always have a kind of fluke mind. As long as it (disease) does not happen to you, you always think the probability of being infected by the disease is zero. (FG2-1, IDIs)

ii. Social level

Organizational activities focusing on emergency response

Follow-up IDIs showed that before medical students' internship, the university would inform medical students the potential risk in clinical internship in hospital setting. However, the university paid more attention to emergency response, rather than vaccination.

Before the internship, the university will hold some conferences to tell us some matters need attention. For example, what measures should we take in case of direct contact patient's blood or contaminated materials or occupational needle stick injuries. Measures including testing five serological markers of HBV and receiving hepatitis B immunoglobulin were mentioned in these conferences (FG3-3, IDIs)

Reduced family's influence and emerging new social norm

We found that influence from families of medical students on their behaviors and attitudes towards vaccination decreased, while influence from their classmates or colleagues raised a lot. Many participants mentioned that students would discuss vaccination issue together or sometimes made an appointment with classmates to test Anti-HBs or vaccinate together. As a result, new social norms were developing among students with the same learning experience and similar risk of occupational infection.

Yeah, during the internship, sometimes we will talk about this issue when we get together. For example, we will ask each other which department you are in now, oh, you are in the department of infectious disease, when do you plan to get vaccinated. (FG2-1, IDIs)

My roommate said that infection risk during the internship was high. He called me to get vaccinated together with him, and we tested Anti-HBs together first, then were vaccinated against HBV together, because both our Anti-HBs are negative. (FG1-3, IDIs)

iii. Professional level

Two-side influences of knowledge

Medical knowledge acquired by medical students may raise their health consciousness and lead to preventive measures. For example, medical students had some knowledge about how a certain infectious disease was transmitted, they might take

corresponding measures such as “wear leather gloves”, “try not to contact patients’ fluids or bloods” to avoid risks. However, medical students might not choose to vaccinate because they thought they could avoid infection risk based on their medicine knowledge.

When you know more, you may not be likely to be infected. For example, I know that HBV is mainly transmitted through blood. I just need to make sure I do not contact closely with it. Last time my hand was stabbed, I told our team leader I could not do clinical practices during that time. You know, that can avoid contact with patients. Another example is about tetanus, tetanus virus needs anaerobic environment. If there is a wound on my hand, I will open both sides of the wound, so anaerobic environment cannot exist in wound, it will not be infected with virus. A person who does not study medicine science may be vaccinated because he does not understand this knowledge. (FG2-1, IDIs)

It is worth noting that some inaccurate knowledge obtained by medical students from their courses may affect their vaccination decisions for a long time. Initial FGIs showed that, some participants mentioned that their teacher told them that influenza vaccine was ineffective. Two years later, 6 participants in follow-up IDIs still did not receive or had strong intentions to receive influenza vaccine. And just two months before follow-up IDIs, on October 22 2018, China issued a document which required HCP to vaccinate against influenza actively. All these 6 participants did not know this document. Explanations given by them were still similar to those given in initial FGIs

Influenza vaccine is not like HepB, bacillus calmette-guerin (BCG), polio vaccine. Influenza viruses can mutate easily and can produce many sub-types. We learned that from Microbiology before. Influenza viruses themselves have many sub-types, so influenza vaccines are not effective. You do not have to receive it, it is not necessary. (FG2-1, follow-up IDIs)

Another noteworthy phenomenon is that there is coexist response in vigilance and numbness way to occupational exposure among medical students. When medical students entered their internship, on the one hand, due to frequent exposure to potential risk, their awareness of infectious diseases was enhanced, however on the other hand, they will be numb to infection risk as they encountered more and more patients. That is to say, medical students used to contact with patients or diseases, so they might relax vigilance, and even thought some prudent behaviors were seen as abnormal. The desensitization to occupational infection risk might be an obstacle to vaccination.

After a period of time in clinical practice, I feel a little indifferent about infection risk, and sometimes I think I could not be infected. Take one of our team leader in hospital for example, he does not wear mask in the process of operations, he dose not do it every day. In fact, you know, doctors are likely to be exposed to potentially infectious materials in some operations such as intubation. The whole trachea is open when intubation operation, all kind of bacterium will come out, droplets are sprayed everywhere. Another example is about me. I am not very worried about influenza, because I see so many influenza patients in hospitals, a patient managed by me also has influenza. Influenza vaccinations are indeed rare among us. One of our classmates received influenza vaccine. We think it seems a little strange for this classmate to do that. (FG2-1, follow-up IDIs)

At the beginning of our internship, we are all very careful. Our moves in operation are very slowly. We are afraid of needlestick injuries, afraid of being splashed with patients’ blood. But now, how to say, we are not so careful, just do basic protection like wearing safety gloves in working. (FG1-3, follow-up IDIs)

4. Discussion

In China, there are no mandatory HCP vaccination programs against VPDs. Therefore whether or not receiving vaccine depends more on their own perceptions towards vaccination. In this study, FGIs and follow-up IDIs were used to explore a variety of interpretations about why they received or did not receive vaccines during university. As a qualitative study, the researchers also tried to find possible relationships among all these interpretations, not only just showed some influencing factors in face.

We found that Chinese medical students were very concerned about the Hepatitis B, especially before or/and during their internship. Hepatitis B is the most frequently mentioned disease that is considered to be at high infection risk by medical staff [5,22]. FGIs showed that just three participants vaccinated against HBV after entering university, and other participants did not care about their immunity status, while 4 of 6 participants in follow-up IDIs were vaccinated against (or have documented immunity to) hepatitis B two years later. A multi-center study in China showed that the coverage rate of three-dose hepatitis B immunization was 59.70% among younger HCP [12]. A lower coverage rate of 34.77% was found among non-medical students [23]. Several latest studies demonstrated a ≥ 1 -dose coverage rate of around 50% [24–26] among non-medical students in China. In these studies, deeper insight qualitative analysis about participants’ attitudes in China was rather limited. We suspect that the practices and perceptions towards vaccination against Hepatitis B among junior medical students seem not obviously different from other people at similar age, while medical students who will soon commence (or have commenced) internship seem more likely to vaccinate. Studies in Germany [27], Australia [16] also found differences between pre-clinical-semester and clinical-semester medical students about vaccination coverage. Some studies indicated that medical students in clinical semester had better knowledge level about VPD than that were in pre-clinical semester [11,28], and were prone to being vaccinated [28]. However, overall, HepB coverage among medical students in China seemed lower than corresponding figure reported in developed countries or areas, where HepB coverage rate can reach to more than 80% [3,16,27,29].

The study showed that medical students in China did not care about influenza, their vaccination coverage was lower than that in health-care workers (about 15%) in China [30], similar to coverage rate in Chinese general population (below 2–3%) [31]. Internationally, medical students demonstrated lower uptake than other HCP population [27,29,32]. Their receipt of influenza vaccine was generally lower than that of HepB. For example, under the same recommendation strategy and fee-for-free policy, influenza vaccination rate among German medical students (34.5%) was much lower than hepatitis B vaccination rate (86.5%) [27]. Public always think influenza is not a very serious disease [33]. However, influenza can cause about 250,000–500,000 deaths per year [34]. Influenza vaccination in HCP can reduce the risk of infection, influenza-like diseases, and absenteeism caused by influenza [35,36]. Further more, influenza vaccination can prevent nosocomial infection and morbidity and mortality of some vulnerable patients like elderly [37,38]. A study showed that mandatory influenza vaccination among HCP could increase coverage to up to 99% in the USA [39], however mandatory policy has not been used yet in most of countries until now [16].

None of the participants reported other vaccines uptake both in FGIs and follow-up IDIs. However outbreaks of mumps, measles, rubella, varicella continue occur in hospital setting or general population in China [15,40–44]. We also did not find vaccination differences between different gender participants.

The present study indicated three level of factors affecting the practices and perceptions of medical students. At individual level, junior participants lacked vaccination awareness, had weak perceived infection risk and strong perceived vaccination barriers (including being busy, inconvenience, vaccine associated costs), while they had high perceived occupational infection risk, strong consciousness about hepatitis B in the period before or/and during internship. Human nature factors such as “fluke mind” and “laziness” existed always. These factors were largely comparable with other studies. These included self-protection, fee for free, convenience as vaccination facilitators [16,21,27,45], and incorrect perceptions about vaccine and infection risk [11,16,27,32,33,46,47], laziness [48], lack of time or being busy [48], forgetting vaccination [46,48], price [7,16], worry about the AEFI [7,46], fear of needles [21] as barriers.

The study argued that factors in individual level were not independent of each other, while many of them interacted. For example, participants' perceived barriers were strong when they had less perceived infection risk, while some barriers like inconvenience and vaccine-associated-cost were seldom mentioned again when perceived occupational infection risk became much higher. And we found that perceived barriers were always used by medical students to hide their “fluke mind” or “laziness”. Liu Yan [49] also indicated in her study that vaccine price was just an excuse for college students to rationalize their refusal to vaccination. And our findings were partially different from Edge's argument which thought that convenience was the most critical factor affecting medical students' vaccination [21].

At social level, medical students' views on vaccination were based on their understanding of the relationship between their health behaviors and different settings including their family, the university and internship hospitals. For example, in FGIs, Some participants explained why they did not consider vaccination from the following reasons: (a) The family took them for vaccination in childhood, so they did not know what kind of vaccines they had received. After entering the university, they left the state of decision made by family members, while they had not yet build self-consciousness about vaccination decision. Therefore, at the beginning of each FGIs, participants seemed a little confused and felt speechless. (b) Medical students thought university as an organization with medical background should consider whether they should be vaccinated or not. They suspected that it was not necessary to think about vaccination if the university took few measures about this issue. Some positive organizational behaviors were found in IDIs, however which paid more attention to emergency response to occupational infection risk rather than vaccination in advance. Okamoto [7] argued that medical students could not accurately remember their immune status in the past, so they need medical colleges or medical institutions to play an organizational role. Hospitals or universities should provide information to HCP through brochures, e-mails, lectures and/or posters, to remove other barriers (such as inconvenience and costs) [16], or carry out vaccination program like Mobile Cart Program [27]. (3) When medical students entered clinical hospital for their internship, they had a certain of medical knowledge, and recognized infection risk in hospital setting, they began to regard themselves as decision-maker on vaccination, rather than being influenced a lot by their families/universities as before. Peer pressure encouraged medical students to follow the behaviors of others with similar experiences [21]. Therefore influence from their classmates was raised.

At professional level, at the early stage of their university lives, most students lacked knowledge about VPDs and vaccination, while the knowledge level and vaccination awareness seemed raised a lot at the later stage. Some inaccurate knowledge would affect students' practices or perceptions towards vaccination. For example, both FGIs and IDIs showed that, almost all participants

considered influenza vaccine was ineffective, and they had less intention to be vaccinated against influenza. And findings showed that potential risk of infection rabies from laboratory animals attracted many students' attentions, however rodents such as mice and rabbits are not primary hosts and do not play a role in the transmission or maintenance of rabies, and post-exposure prophylaxis (PEP) is not indicated after a rodent bite [50]. Vaccination recommendations to HCP in the United States [1] and Europe [2] did not include human rabies vaccination.

The inadequacy of medical students' occupational prevention knowledge exists globally and is related to students' grade [3]. A German study also indicated that medical students were not entirely correct about the severity of hepatitis B and influenza and vaccine characteristics [27].

The contradiction is that the study indicated that medical students sometimes seemed too satisfied about their medical knowledge to vaccination. For example, they might not choose to vaccinate because they thought they could avoid infection risk based on their medical knowledge.

The study showed that medical students might fall into another contradiction about their preventive practice. There were both vigilant mind and fluke mind, and there were both vigilance response and desensitization to occupational infection risk. The finding has received limited study, although Edge [21] had argued that doctors would be the worst patients and might not be compliance with health care advice like vaccination.

In addition, this study did not show that medical students decided to vaccinate from the perspective of protecting patients. Carman [51] also found that only a few medical students were concerned about patient safety. Studies in Australia [16] and Japan [7] showed that protecting patients/family/friends was also a motivator for medical students' immunization. Several studies indicated that someone who was more concerned about patient safety was more likely to be vaccinated against influenza [7,16,21,27,45]. Setting an example for patients is also as a motivator for HCP vaccination [27]. HCP have a moral and ethical responsibility to prevent the spread of vaccines to patients [52].

5. Conclusion

This is the first qualitative empirical study on medical students' practices and perceptions about vaccination in China. The implications from this study can be concluded as follow:

- (1) Efforts should be strengthened to spread scientific knowledge of VPDs and corresponding vaccination as long as medical students enter the university [3,47,53]. Especially for some VPDs like influenza that are underestimated by medical students. Moreover, low risk of infecting with rabies when bitten by an experimental rodent should be made clear to students, in order to avoid their overly worrying about it and spending money on unnecessary vaccination.
- (2) More publicity and organizational activities should be carried out in the university or medical students' clinical hospitals. Measures taken from organizational level can reduce students' perceived barriers and fluke mind, thereby facilitating vaccination of students [16], and can also change many participants' practices and enhance a more positive social norm for vaccination. In addition, medical students' desensitization to infection risk also need organizational intervention.
- (3) The study show that HCP including medical students, do face a higher risk of infection diseases in hospital setting in China. At present, there are still very limited researches on preventive measures of these population. Most of vaccines recommended to HCP internationally, such as vaccines

against hepatitis B, mumps, rubella, varicella and so on received less attentions of the government and individual health care worker until now. The state and researchers need to carry out relevant research projects to understand the overall situation of HCP vaccination, so as to formulate relevant guidelines accordingly.

One potential limitation of our study is that study was conducted at a single medical university which may limit generalizability, although there are no indications so far that this participants in this study are significantly different from those in other Chinese medical universities.

Competing Interests

The authors declare they have no competing interests.

Availability of data and materials

Data can be made available by request.

Authors contributions

WL and ZX designed the study, discussed the methodology, and contributed to drafting the paper. WL conducted focus group interviews and follow-up in-depth interviews. ZQ assisted in coding and contributed to drafting the paper. ZS assisted in conducting interviews and clearing up and transcribing records. WL contributed to the production of the final draft. All authors read and approved the final manuscript.

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