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A matter of trust: a qualitative comparison of the determinants of COVID-19 vaccine hesitancy in Taiwan, the United States, the Netherlands, and Haiti

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ABSTRACT

COVID-19 vaccination is an effective intervention preventing individuals from contracting SARS-CoV-2 or transmitting the virus to others. However, in many countries, vaccine hesitancy has impeded the progress of mass vaccination to reach herd immunity. This study aimed to understand the similarities and differences in the determinants of COVID-19 vaccine hesitancy in Taiwan, the United States, the Netherlands, and Haiti. A qualitative study was conducted by face-to-face interviews with participants in Taiwan and remote online interviews with participants in the United States, the Netherlands, and Haiti. In total, 47 interviews were conducted. A reflective thematic analysis was employed to analyze the collected data. Distrust of COVID-19 vaccines was reported by the participants in all countries. A perception of a lack of necessity or urgency to be vaccinated was reported by the Taiwanese and Haitian participants. Lack of knowledge regarding COVID-19 vaccines was reported by the Taiwanese, U.S. and Haitian participants, contributing to hesitation or refusal to vaccination. Regarding misinformation and rumors, misinformation was found among a few Taiwanese and Dutch participants. Additionally, rumors concerning COVID-19 vaccines were mentioned by the Dutch and Haitian participants. Furthermore, a lack of verified information was reported by the participants in all four countries. Overall, the current study suggests that vaccine hesitancy exists among participants in Taiwan, the United States, the Netherlands, and Haiti. Building trust in the COVID-19 vaccine, cultivating vaccine literacy, clarifying misinformation and rumors concerning COVID-19 vaccines, and providing verified information are critical for increasing public acceptance of the COVID-19 vaccine.

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Introduction

The current SARS-CoV-2 pathogen has exerted global effects with greater than 450 million confirmed cases and 6 million deaths of COVID-19 since 2019.¹ One year after the COVID-19 outbreak, COVID-19 vaccines are available, and they have been viewed as an effective or perhaps the only way to eradicate COVID-19. To date, several COVID-19 vaccines, including those developed by Pfizer, AstraZeneca, and Johnson & Johnson,² have been developed in an unprecedentedly short timeframe due to global efforts.

Thus far, COVID-19 vaccination programs have been operational in at least 200 countries and territories, with approximately 10.9 billion vaccine doses being globally administered.³ In particular, U.A.E, Portugal, Chile, Cuba, and Singapore have achieved a fully vaccination rate of over 87% of the population against COVID-19.³ Widespread vaccination uptake is crucial to reduce the spread of the virus and to have an opportunity to return to normal; however, vaccine hesitancy might be a major concern to achieving this goal. Vaccine hesitancy is defined as “*delay in acceptance or refusal of vaccination despite the availability of vaccination services*”,⁴ and it was listed as one of the top ten global health threats in 2019 by the WHO.⁵

COVID-19 vaccines offer hope for ending the pandemic; however, there is no guarantee that a sufficient proportion of the population will elect to receive COVID-19 vaccines. A previous global survey indicated that achieving herd immunity may be difficult based on individuals’ willingness to accept COVID-19 vaccines worldwide.⁶ It is necessary to understand why individuals are hesitant and resistant to vaccination.

According to the SAGE (Strategic Advisory Group of Experts on Immunization) working group on vaccine hesitancy, the vaccine hesitancy determinant matrix includes three categories, namely, individual and group influences, contextual influences, and vaccine/vaccination-specific factors.^{4,7}

Regarding the individual factors, individual risk perception^{8,9} was associated with COVID-19 vaccine hesitancy. Additionally, individual beliefs and attitudes concerning health and prevention, such as a preference for natural immunity,^{10,11} and lack of knowledge regarding COVID-19 vaccines^{12,13} have also been found to be related to COVID-19 vaccine hesitancy. Additionally, previous studies have suggested several contextual influences related to COVID-19 vaccine hesitancy. For example, communication and the media environment (e.g., misinformation and rumors^{14,15} and the information environment,¹⁶

influential leaders (e.g., anti-vaxxers,¹⁷ and historical influences (e.g., unethical medical practices in the black community¹⁸ have been related to COVID-19 vaccine hesitancy. Furthermore, empirical research has suggested that a lack of trust is a key factor associated with COVID-19 vaccine hesitancy.^{19,20}

To date, the COVID-19 vaccination rate varies across countries, and COVID-19 vaccine hesitancy remains complex. Considering that vaccine hesitancy may threaten achieving widespread vaccination across different countries, this study aimed to obtain a deeper understanding of the determinants of COVID-19 vaccine hesitancy in four countries from different geographic regions, namely, Taiwan, the United States (U.S.), the Netherlands, and Haiti. These four countries located in Asia, North America, Europe, and the Caribbean, respectively, have very different socio-cultural contexts and vaccination statuses, allowing a more extensive overview of COVID-19 vaccine hesitancy during the pandemic.

Material and methods

Study setting

Taiwan is a country located in East Asia that is in close proximity to China and has achieved a successful outcome in tackling the COVID-19 pandemic by implementing the Taiwan model²¹ prior to April 2021. However, COVID-19 vaccination in Taiwan lagged behind that in other developed countries, starting late on March 22nd, 2021, which was probably one of the reasons the COVID-19 outbreak in Taiwan occurred in May 2021. Before May 2021, 0% of the population had been fully vaccinated against COVID-19. To date, 75.64% of the Taiwanese population has been fully vaccinated against COVID-19.³

In the United States, which has had the most COVID-19 confirmed cases worldwide, approximately 64.90% of the population has been fully vaccinated against COVID-19 now.³ Despite the unprecedented rate of COVID-19 vaccination, the vaccination gap among states indicates that COVID-19 vaccination hesitancy exists among the U.S. population.²²

The Netherlands, a country located in Western Europe, has been implementing a COVID-19 vaccination program since January 2021; 71.95% of the Dutch population has been fully vaccinated.³ Noteworthy, previous research has identified that residents of the Netherlands had the lowest confidence in the MMR vaccine in 2020 across the European Union.²³

Haiti, a Caribbean country, was among the last countries to be affected by COVID-19 in March 2020 and is facing challenges in fighting the COVID-19 pandemic due to resource shortages and fragile health systems.²⁴ Compared to other countries, COVID-19 vaccination started late in mid-July, 2021. To date, less than 1% of the Haitian population has been fully vaccinated.³ A previous study reported that Haiti had the lowest prevalence of COVID-19 vaccination intention compared to other Latin American and Caribbean countries.²⁵

Study design, participants, and sampling

This study adopted a qualitative design conducted from November 2020 to March 2021. The participants were recruited by snowball sampling as well as convenience sampling. The

researchers used their social networks to recruit the primary sampling unit for the interviews. Afterward, the participants who agreed to participate in this study nominated more participants, who represented the secondary data source; these participants then nominated another set of participants, and so on. The participants were recruited until saturation was reached. Additionally, Taiwanese participants were recruited online via the PTT Bulletin Board System (the largest terminal-based bulletin board system in Taiwan) to access more participants in Taipei City.

Data collection

A short-structured questionnaire was used to collect the participants' sociodemographic characteristics (e.g., age, gender, education level, etc.) before the interviews. Table 1 displays the interview guide used in this study. The topics of the interview guide included (1) the participants' knowledge and risk perception of COVID-19; (2) the participants' opinions or perspectives on COVID-19 vaccines; (3) their confidence in COVID-19 vaccines; and (4) their perceived benefits or negative influences of receiving a COVID-19 vaccine.

The research team was trained regarding how to conduct in-depth interviews before the formal study to ensure the research quality. Several meetings and in-depth interview practice sessions were held from September to October 2020. CWW

Table 1. Interview guide used to explore the factors influencing COVID-19 vaccine hesitancy.

Topics and questions	Follow up/Probing
1.Knowledge and risk perception of COVID-19	
a.Can you tell me about your opinion/perspective/experience of COVID-19?	Opinion/perspective/experience of COVID-19
b.In your view, what do you think about your risk of getting COVID-19?	If yes, what are the reasons? If no, what are the reasons?
2.Opinion or perspective on COVID-19 vaccine	
a.Can you tell me about your opinion or perspective on COVID-19 vaccines?	Knowledge of COVID-19 vaccines
b.COVID-19 vaccines could be ready by year end or early next year. Do you consider getting a coronavirus vaccine if it is available?	If yes, what are the reasons? If no, what are the reasons?
c.What do you think about your need to get vaccinated?	Self-assessment of the need to get vaccinated
d.How necessary do you think COVID-19 vaccines are?	The necessity of COVID-19 vaccines
e.In your view, who should receive a COVID-19 vaccine?	Probe occupation, generation, sex, age, etc.
f.Does your religion/philosophy/culture recommend against vaccination? What is the reason?	Religion/philosophy/culture influence
3.Confidence in COVID-19 vaccines	
a.Do you trust that COVID-19 vaccines are effective?	If yes, what are the reasons? If no, what are the reasons?
b.Do you believe that COVID-19 vaccines are safe? (What are your concerns or worries about vaccine safety?)	If yes, what are the reasons? If no, what are the reasons?
c.Do you have access to information/resources that could help you address these concerns?	Resources used to resolve concerns
4.Perceived benefits or negative influences of receiving COVID-19 vaccination	
a.What do you think about the benefits of receiving a COVID-19 vaccine?	Probe physical health and social and culture impacts
b.What do you think about the negative influences of receiving COVID-19 vaccine?	Probe physical health and social and culture impacts

conducted in-depth face-to-face interviews with the participants in Taipei City, Taiwan. JLE, EPJ, and JAF conducted remote online interviews via Skype or WhatsApp to interview the participants in the United States, the Netherlands, and Haiti, respectively. Each interview lasted approximately 20 to 40 min.

The interviews were conducted in Chinese, English, Dutch, or Haitian Creole by four interviewers to lower the language barriers and make the participants feel comfortable while answering the questions. Although an interview guide was developed for this study, the four interviewers kept the interviews flexible, and the interview questions were modified if necessary (depending on the response from the participants). The participants could also choose not to answer the questions.

All interviews were audio- and/or video-recorded with the participants' permission. After the interview, the researchers provided a \$20 coupon or gift to each participant in appreciation for their participation.

Data processing and analysis

The interview recordings were transcribed manually, and Express Scribe Transcription Software was used to help transcribe quickly (e.g., playback speed control) during the transcription. The interviews conducted in Chinese and English were transcribed verbatim by CWW and JLE, respectively. Additionally, the interviews in Dutch and Haitian Creole were translated to English by bilingual researchers of Dutch or Haitian nationality (EPJ and JAF). All interviews were listened to many times with the transcripts to ensure the quality. The transcripts were typed as Word documents and imported into QSR International NVivo 12 for the analysis.

Reflexive thematic analysis was adopted to analyze the data²⁶ because it is seen as less complex and more straightforward,²⁷ it fits the research question in this study, it can be used to analyze in-depth interviews, and it has no specific requirement for sampling.²⁸ The vaccine hesitancy determinant matrix developed by the SAGE working group on vaccine hesitancy⁴ was used as a reference to guide the coding process. CWW read and reread all transcripts to become familiarized with the data. Initial codes were generated after the first cycle coding. Pattern coding was used in the second cycle coding, and similar codes were grouped together as categories.²⁹ The codes and categories were refined and placed into subsequent themes. The themes were then defined and named with consideration of the determinants of COVID-19 vaccine hesitancy. To enhance the trustworthiness of the data analysis, EPJ and CHSC coded one-fourth of the transcripts each to ensure the consistency of the codes, categories, and themes. Finally, investigator triangulation was used to confirm the findings and analytic rigor.

Reflexivity

The investigators are from four different countries, namely, Taiwan, the United States, the Netherlands, and Haiti. In general, the Taiwanese, U.S., Dutch, and Haitian investigators have diverse experiences with vaccination. In their childhood, they received many vaccines (e.g., Varicella vaccine, Hepatitis B vaccine, MMR, DTaP, etc.). Overall, the researchers may

convey a more favorable attitude toward vaccination. Nevertheless, the investigators had limited to no control over childhood immunization due to parental consent.

In addition to the aforementioned claim, the Taiwanese, U.S., and Haitian investigators admit that they also had some doubts regarding the COVID-19 vaccines because they thought that the COVID-19 vaccines were developed rather quickly in contrast to traditional vaccine development. In contrast, the Dutch investigator has a pharmaceutical background and working experience in a pharmaceutical company for several years; he has better knowledge of how vaccines are developed and the clinical trial process. He thinks that vaccines are safe and effective once they are developed. Based on his background and knowledge, he does not think the COVID-19 vaccines were developed hastily, and he trusts COVID-19 vaccines once they are placed on the market for use. Regarding the relationship between the investigators and participants, some participants were recruited from the investigators' social networks; thus, the investigators might have influenced some participants' attitudes toward COVID-19 vaccines. As noted above, these factors may have contributed to potential influences on the data collection, data analysis, and interpretation process in this study.

Ethical approval

All participants provided written or electronic informed consent. This study was performed in accordance with the Declaration of Helsinki and was approved by the Research Ethics Committee of National Taiwan University (202008HS023).

Results

Table 2 shows the participants' characteristics. A total of 47 interviews were conducted with participants in Taiwan, the U.S., the Netherlands, and Haiti. Nearly half of the participants (44.7%) were between 20 and 29 years old, and the majority were female (72.3%). Additionally, nearly half of the participants (44.7%) had a master's degree. The majority of the participants (78.7%) reported that they did not receive influenza vaccines last season or this season.

In the interviews, when asked about their willingness to receive a COVID-19 vaccine when the vaccine was available, 42.6% of the participants (20/47; Taiwan: 1; the U.S.: 6; the Netherlands: 8; Haiti: 5) reported that they were willing to receive a COVID-19 vaccine. However, 25.5% of the participants (12/47; Taiwan: 6; the U.S.: 2; the Netherlands: 1; Haiti: 3) said that they would not be vaccinated. In addition, 31.9% of the participants (15/47; Taiwan: 7; the U.S.: 5; the Netherlands: 1; Haiti: 2) were hesitant to receive a COVID-19 vaccine. In this study, 25 codes, 11 categories, and 5 themes were identified to address the determinants of COVID-19 vaccine hesitancy. Table 3 presents the frequency of the codes, categories, and themes generated from the interviews across four countries. The themes and categories are presented with supportive quotes below.

Table 2. Participant characteristics (N = 47).

Variable	Taiwan (n = 14)		U.S. (n = 13)		Netherlands (n = 10)		Haiti (n = 10)		Total (N = 47)	
	n	%	n	%	n	%	n	%	n	%
Age										
20-29	6	42.9	10	76.9	1	10.0	4	40.0	21	44.7
30-39	6	42.9	0	0.0	2	20.0	4	40.0	12	25.5
40-49	0	0.0	1	7.7	0	0.0	0	0.0	1	2.1
50-59	0	0.0	1	7.7	2	20.0	2	20.0	5	10.6
≥60	2	14.3	1	7.7	5	50.0	0	0.0	8	17.0
Sex										
Male	3	21.4	3	23.1	1	10.0	6	60.0	13	27.7
Female	11	78.6	10	76.9	9	90.0	4	40.0	34	72.3
Education										
High school	0	0.0	1	7.7	0	0.0	0	0.0	1	2.1
Bachelor's	8	57.1	4	30.8	0	0.0	3	30.0	15	31.9
Master's	5	35.7	8	61.5	3	30.0	5	50.0	21	44.7
Doctorate	1	7.1	0	0.0	0	0.0	2	20.0	3	6.4
HBO in the Netherlands	0	0.0	0	0.0	6	60.0	0	0.0	6	12.8
MBO in the Netherlands	0	0.0	0	0.0	1	10.0	0	0.0	1	2.1
Marital status										
Single/never married	12	85.7	10	76.9	2	20.0	5	50.0	29	61.7
Married/living together	2	14.3	3	23.1	5	50.0	3	30.0	13	27.7
Divorced	0	0.0	0	0.0	0	0.0	2	20.0	2	4.3
Widowed	0	0.0	0	0.0	2	20.0	0	0.0	2	4.3
Other	0	0.0	0	0.0	1	10.0	0	0.0	1	2.1
Received last season's or this season's influenza vaccine										
Yes	4	28.6	2	15.4	4	40.0	0	0.0	10	21.3
No	10	71.4	11	84.6	6	60.0	10	100.0	37	78.7

HBO, higher professional education; MBO, senior secondary vocational education and training.

Theme 1: lack of trust

Distrust of COVID-19 vaccines

There was distrust surrounding COVID-19 vaccines that led to people feeling hesitant about or refusing vaccination. The participants in all four countries reported that they distrusted COVID-19 vaccines because they were developed very quickly.

With the vaccine . . . I am kind of hesitant due to the fact that vaccines get produced awfully fast, awfully quick. And, I'm just trying to figure out what nationality is this vaccine going to hurt. [the U.S. 01, F, 40 s]

Additionally, the safety of COVID-19 vaccines was a major concern frequently mentioned by the participants in all four countries; many elaborated that they worried about severe side effects and long-term effects from the newness of COVID-19 vaccines that could occur if they were to be vaccinated.

I couldn't trust the safety of COVID-19 vaccines. I think that vaccines should be developed and tested for many years . . . I worry that maybe you are fine now when you get vaccinated but you don't know the adverse effects from the vaccines after 5 or 10 years. [Taiwan 11, F, 30 s]

In addition to safety, the participants in all four countries reported that they distrusted the effectiveness of COVID-19 vaccines. Such distrust originated from the speed of the development of the vaccines and the rush to put them on the market.

Nevertheless, the participants mentioned that they believed that the COVID-19 vaccines would not be effective against COVID-19 variants.

Based on the information that I receive from the news, I know that the virus constantly changes, so I think that the vaccines will be ineffective if the virus mutates again and again. [Taiwan 06, F, 30 s]

Distrust in the pharmaceutical industry

The interview findings showed that vaccine hesitancy or refusal may originate from participants' distrust of the pharmaceutical industry. The participants in all four countries reported that they distrusted the pharmaceutical industry. They perceived that pharmaceutical industries rushed to place COVID-19 vaccines on the market and that the development of the vaccines was a competition among pharmaceutical industries.

I just think Big Pharma, you know, they just . . . they rushed to put something on the market, said, 'We are the first ones to develop the vaccine' . . . So, you know, it's like it's a race to put something on the market even if it's not effective, you know. They said its ninety-five percent, ninety-three percent . . . So, you know, I had my doubts about . . . if it would be safe for us. [the U.S. 11, M, 50 s]

Furthermore, some Taiwanese and Dutch participants mentioned that they were unsure regarding whether the results of the clinical trials were reliable. In particular, the Dutch participants mentioned that they had a slight concern regarding the AstraZeneca vaccine because some mistakes (dosage error) seemed to occur while the company was conducting clinical trials, and, thus, the participants perceived that the clinical trial results were untrustworthy.

I must say, I was and still am a bit concerned about the Oxford AstraZeneca vaccine because of them kind of appearing to rush out with stuff . . . they had combined several studies that actually were different dosages and different protocols. Actually, you couldn't tell in terms of the different groups, young people, old people . . . There were different time lapses between giving the 1st and the 2nd dose, but also just more the idea that they had kind of cheated a little bit and what they said, that's what makes you uncertain about how reliable they are. [the Netherlands 09, F, 70 s]

Distrust in government entities

Some U.S. participants explained that their distrust of COVID-19 vaccines was based on the role of political factors in vaccine development in the rush to approve the vaccines for use before the presidential election. They perceived that corruption existed between government entities and that the pharmaceutical industry expedited the vaccine approval process.

I think I distrusted, you know, the what . . . the timeline of a vaccine and yet, the effectiveness of a vaccine under the Trump administration, because it just seemed like there was some obvious coordination between the pharmaceutical industry, which is . . . which can be very corrupt, which is very corrupt, like the pharmaceutical industry and President Trump, a couple of other entities. [the U.S. 08, M, 20 s]

Table 3. Frequency of the codes, categories, and themes generated from the semistructured interviews across four countries.

Code	Setting			
	TWN	U.S.	NLD	HTI
Theme 1: Lack of trust				
Category: Distrust of COVID-19 vaccines				
1.Developed very quickly	10 (32.3%)	10 (32.3%)	6 (19.4%)	5 (16.1%)
2.Concerns regarding safety	30 (37.0%)	18 (22.2%)	10 (12.3%)	23 (28.4%)
3.Concerns regarding effectiveness	18 (34.0%)	13 (24.5%)	5 (9.4%)	17 (32.1%)
Category: Distrust in the pharmaceutical industry				
4.Rushed to place the vaccine on the market	5 (18.5%)	8 (29.6%)	10 (37.0%)	4 (14.8%)
5.Doubt that clinical trials were reliable	4 (50.0%)	0 (0.0%)	4 (50.0%)	0 (0.0%)
Category: Distrust in government entities				
6.Rushed to approve the vaccine for use	0 (0.0%)	3 (100.0%)	0 (0.0%)	0 (0.0%)
Theme 2: Individual-level influences				
Category: Individual risk perception				
7.Perceived lack of necessity or urgency	23 (65.7%)	0 (0.0%)	0 (0.0%)	12 (34.3%)
8.Perceived low risk from getting COVID-19	15 (53.6%)	0 (0.0%)	0 (0.0%)	13 (46.4%)
Category: Beliefs and attitudes regarding health and prevention				
9.Preference for natural immunity against COVID-19	12 (92.3%)	0 (0.0%)	0 (0.0%)	1 (7.7%)
10.Adopt other precautionary measures	5 (55.6%)	0 (0.0%)	0 (0.0%)	4 (44.4%)
11.Lack of knowledge regarding COVID-19 vaccines	6 (40.0%)	6 (40.0%)	0 (0.0%)	3 (20.0%)
Theme 3: Contextual influences-communication and the media environment				
Category: Misinformation and rumors				
12.Get COVID from vaccines	3 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
13.Vaccines can affect a woman's fertility	0 (0.0%)	0 (0.0%)	2 (100.0%)	0 (0.0%)
14.Vaccines are tested in black and low-incomes countries	0 (0.0%)	0 (0.0%)	0 (0.0%)	8 (100.0%)
15.COVID-19 is not real	0 (0.0%)	0 (0.0%)	2 (33.3%)	4 (66.7%)
16.Microchip conspiracy theory	0 (0.0%)	0 (0.0%)	6 (66.7%)	3 (33.3%)
Category: Information environment				
17.Information is inconsistent and overwhelming	0 (0.0%)	1 (20.0%)	4 (80.0%)	0 (0.0%)
18.Lack of verified information to make decision	11 (22.4%)	12 (24.5%)	10 (20.4%)	16 (32.7%)
Theme 4: Contextual influences-influential leaders and historical factors				
Category: Anti-vaccination lobbies				
19.Anti-vaxxers	0 (0.0%)	2 (20.0%)	8 (80.0%)	0 (0.0%)
Category: Historical influences				
20.Tuskegee syphilis experiment	0 (0.0%)	3 (100.0%)	0 (0.0%)	0 (0.0%)
21.Black community	0 (0.0%)	6 (42.9%)	0 (0.0%)	8 (57.1%)
Theme 5: Vaccine/vaccination-specific issues				
Category: Mode of administration				
22.Fears or caution regarding injection	7 (87.5%)	1 (12.5%)	0 (0.0%)	0 (0.0%)
23.Getting vaccinated twice	0 (0.0%)	0 (0.0%)	2 (100.0%)	0 (0.0%)
Category: New vaccines				
24.Wait and see	27 (57.4%)	13 (27.7%)	2 (4.3%)	5 (10.6%)
25.Many unknowns regarding COVID-19	5 (35.7%)	1 (7.1%)	2 (14.3%)	6 (42.9%)

More than one mention per interview is possible. TWN, Taiwan; U.S., the United States; NLD, the Netherlands; HTI, Haiti.

Theme 2: individual-level influences

Individual risk perception

During the interviews, most Taiwanese and Haitian participants reported that COVID-19 vaccine uptake was not a necessary preventive measure or that it was not urgent to be vaccinated. They explained that they were young and healthy and not members of at-risk groups (e.g., elderly individuals, frontline workers or healthcare workers).

I don't think I have the need (to be vaccinated) or that it is necessary for me to take the vaccine right now. If I were sick with the virus, I would consider being in need, but for my age, where I am living, all the prevention I take (wearing a face mask and social distancing), I don't think it is necessary for me to take the vaccine even if it's considered to be a preventive measure to protect you from getting infected. [Haiti 05, M, 30 s]

Furthermore, most Taiwanese and Haitian participants explained that they perceived a low risk from contracting COVID-19 and a sense of security since the number of COVID-19 cases was relatively low compared to that in other countries.

I can say I don't think it (COVID-19) affects me in any ways now. I think it's because I am living in Haiti, and I don't see any high incidence and prevalence of the disease . . . I don't think I need to get a COVID-19 vaccine. [Haiti 06, M, 30 s]

I don't see the necessity to get vaccinated because I don't travel overseas. As I mentioned earlier, I feel safe staying in Taiwan. [Taiwan 03, M, 30 s]

Beliefs and attitudes regarding health and prevention

A preference for natural immunity over vaccination was reported by some Taiwanese participants and a few Haitian participants. They believe that their natural immunity can fight the virus and is better than vaccination.

I prefer not to get vaccinated. I'm not getting flu shots or other vaccines. I believe that my natural immunity (against the virus). [Taiwan 07, F, 30 s]

Additionally, some Taiwanese and Haitian participants explained that they preferred to adopt precautionary measures (e.g., hand washing, social distancing, and mask-wearing) other than getting vaccinated.

I think the COVID-19 situation is stable in Taiwan, so it's not urgent to get vaccinated. I would like to wait and see, and I can continue to wear a mask. [Taiwan 08, F, 20 s]

Furthermore, the interview findings showed that vaccine hesitancy or refusal may originate from the participants' lack of knowledge regarding COVID-19 vaccines. Some Taiwanese, American, and Haitian participants mentioned that they did not understand the vaccines or did not know the ingredients in the vaccine; therefore, they were hesitant or refused to get vaccinated.

I don't clearly know what's in it (the COVID-19 vaccine), that's mainly. I don't know what they're putting in my body. [the U.S. 09, M, 20 s]

Theme 3: contextual influences-communication and the media environment

Misinformation and rumors

One piece of misinformation mentioned by a few Taiwanese participants was that COVID-19 vaccines involve injecting the COVID-19 virus into the body and that people who are vaccinated would contract COVID-19 from the vaccines.

I feel terrified about the vaccination. It looks like you are injecting the COVID-19 virus into your body ... and I will probably get COVID after vaccination. [Taiwan 14, F, 20 s]

In addition, one Dutch female participant stated that she worried that COVID-19 vaccines might affect women's fertility. Therefore, she preferred to wait and see whether COVID-19 vaccines were harmless.

But for us (the participant and her husband), we are in our 30 s and still want to have kids ... are in the prime of our lives and we are still waiting and watching for long-term consequences (of the vaccination) ... People at our age are also more careful, especially female friends, concerning fertility. My fellow friends also have doubts or worries about the vaccine; they also don't want it right away. [the Netherlands 10, F, 30 s]

Regarding the rumors concerning COVID-19 and COVID-19 vaccines, three types of rumors were mentioned by the Dutch and Haitian participants. First, the majority of Haitian participants noted the rumor that COVID-19 vaccines would be tested in black and low-income countries and would decrease the populations of poor countries or black people.

In Haiti, there are some rumors about the vaccines. They said it is poison; they want to poison poor countries population. They are too crowded. It is a conspiracy, etc. ... And, also, culturally, Haitian people don't like vaccines, and with those rumors, it is unlikely that Haitians will take the vaccines. [Haiti 01, M, 30 s]

Second, while discussing the social atmosphere of COVID-19, half of the Haitian participants stated that some Haitian people did not believe that COVID was real since there were few cases and deaths in Haiti. They did not observe severe outcomes from COVID-19.

Given that we are living in Haiti, there's a lack of awareness among the population. They don't care about COVID-19, and some of them think it is not true, it doesn't exist ... I have heard Haitian people are skeptical about the COVID-19 vaccines. [Haiti 07, F, 30 s]

Similarly, some Dutch participants also stated that some people in their country did not believe that COVID-19 was real; these beliefs originated from conspiracy thinkers and affected people's willingness to be vaccinated in their country. Finally, some Dutch and Haitian participants mentioned the rumors or conspiracy theories they heard regarding Bill Gates's "microchip".

That it is impossible to develop a vaccine in half a year and we have, I always make jokes about this, but there are people who say that with the vaccine, they inject a chip ... We now have the new 5G transmission towers ... With these 5G towers they could read your chip then ... Yes, that is Bill Gates. [the Netherlands 02, F, 60 s]

Information environment

The quality of information could also affect people's willingness to receive COVID-19 vaccines. Some Dutch participants and a few U.S. participants said that the information regarding COVID-19 vaccines they received was inconsistent and overwhelming.

When I now do read about the differences between the vaccines, then, I do think, I become unhappy about that. What does it do at the end? Then, there are so many questions about that then that I also stopped reading about that because I cannot track that myself ... Also, because of virologists who contradict each other, then, I think ... well ... you can't differentiate any longer between good and bad ... [the Netherlands 05, F, 60 s]

Additionally, the participants in all four countries said that they received information regarding COVID-19 vaccines from news, newspapers, TV programs, and social media. However, they frequently stated that verified information regarding COVID-19 vaccines that could help them make the decision regarding getting vaccinated was lacking. Additionally, they said that they did not know whether COVID-19 vaccines were effective due to a lack of information that would allow them to make a judgment.

I guess I don't want to say that I'm a little bit skeptical because I've seen. But, then again, you know, I haven't really seen verified information. The information I got has been via Twitter, via social media. And, I've seen a lot where people talk about the side effects of it and how a lot of people have been getting the bad side effects from it. [the U.S. 07, F, 20 s]

For now, I cannot say if it would be effective or not; I don't have much information, and I think we will know more about its effectiveness after, because people are receiving the vaccines. Now we need to see the effects it's going to have on people's health, the results before saying it is effective or not. [Haiti 07, F, 30 s]

Theme 4: contextual influences-influential leaders and historical factors

Anti-Vaccination lobbies

Some U.S. and Dutch participants mentioned their concerns regarding a relatively small group of anti-vaxxers against COVID-19 vaccination in society. In general, these anti-vaxxers spread coronavirus conspiracy theories, such as COVID-19 vaccines containing microchips, COVID-19 does not exist, the virus is not as severe as claimed, and that vaccination is bad.

Yeah, well, of course, there's a really big anti-vaxxer (population) here ... And then, of course, with COVID inoculations, those groups have swelled up and maybe even gotten bigger by, you know, the kind of radical right that, you know, in the Bill Gates, the pedophile ... you know it's a problem ... It's a conspiracy theory. [the Netherlands 09, F, 70 s]

Historical influences

During the interviews, historical influences were reported by the U.S. and Haitian participants. They explained why some black people were hesitant to get vaccinated. Historically, unethical medical practices, such as the Tuskegee syphilis experiment, still stirs wariness concerning COVID-19 vaccines among the black community. In addition, the Haitian participants culturally dislike vaccines and fear that they could poison them.

But I know, like historically, there has been a negative connotation of vaccines just because of Americans' like racist history and public health. So, I know like with the Tuskegee syphilis experiment, things like that, some black Americans are wary of public health interventions. [the U.S. 10, F, 20 s]

But culturally, Haitians don't like getting vaccinated because they think they can get poisoned etc.; if they don't understand it, they won't trust it and won't get it. [Haiti 04, F, 20 s]

Theme 5: vaccine/vaccination-specific issues

Mode of administration

Fear or concern regarding injection was reported by some Taiwanese participants and a few U.S. participants. They described their worries and explained that they were very cautious or afraid of being vaccinated. Such worries were based on the fact that they did not know the content of the vaccines or that they scarcely put foreign material in their bodies.

You hate to input something into your body. You really don't know what are you getting, you know, what is in this vaccine? We don't know. [the U.S. 01, F, 40 s]

Vaccination is injecting something into the body. I'm terrified about that. [Taiwan 06, F, 30 s]

Additionally, the need for multiple doses of COVID vaccines might affect people's willingness to receive COVID-19 vaccines. Some Dutch participants mentioned that COVID-19 vaccines have to be administered twice, which might lead some people to be hesitant or refuse to receive the vaccines.

I feel really uncomfortable knowing that there is a COVID vaccine that you need to get in two parts. First, you get this part, that will merge with cell particles, and then, there is a reaction, and then, a month later, you need to get another vaccine, and that will react again. But, I do not believe that people will get two vaccines. [the Netherlands 02, F, 60 s]

New vaccines

During the interviews, a wait-and-see attitude toward COVID-19 vaccines was commonly reported by the Taiwanese and U.S. participants and, to a lesser extent, among the

Netherlands and Haitian participants. The participants explained that COVID-19 vaccines are new and that they prefer to wait and see to observe the consequences among vaccinated people.

I will wait and see because COVID-19 vaccines are new ... I don't know its side effects. [Taiwan 07, F, 30 s]

Hmmm, I don't ... I don't ... I have to see, like, you know, the side effects a lot of people ... I have to watch other people to do it for yes. [the U.S. 09, M, 20 s]

Furthermore, some participants were skeptical regarding these new COVID-19 vaccines and concerned because of how quickly the COVID-19 vaccines were developed, and they perceived that there were still many unknowns regarding the COVID-19 virus.

I just feel like ... there's a lot of distrust, for me personally right now, just because of how quickly it (the vaccine) was made and there is a lot of mystery still surrounding the virus and just not knowing a lot and then, it's just a lot of uncertainty, if that makes sense. [the U.S. 03, F, 20 s]

They don't even have all the information about the COVID-19 virus; they even don't know if there are different types, strains of it, so, saying that you have developed a vaccine for something you don't even understand is quite difficult and complicated ... So, for me, it is too early to talk about the vaccine, and I prefer to take care of myself than taking it (the vaccine). [Haiti 01, M, 30 s]

Discussion

The results of this qualitative study confirm that vaccine hesitancy existed among the participants from Taiwan, the United States, the Netherlands, and Haiti, and they provide elaborate insight into of the similarities and differences in the factors influencing COVID-19 vaccine hesitancy across these four countries.

The interview findings revealed that a lack of trust plays a critical role in influencing the willingness to receive a COVID-19 vaccine. Consistent with previous studies,^{9,10,20,30} the short development time, concerns regarding safety, and concerns regarding effectiveness were reported by the participants from all four countries. Additionally, the participants from all four countries perceived that the COVID-19 vaccines were rushed to be placed on the market by pharmaceutical companies, which is a finding consistent with previous studies.^{10,20} Furthermore, the perception that the COVID-19 vaccines were rushed to be approved for use by U.S. government entities was mentioned only by the U.S. participants. Education campaigns tailored to building trust can improve the willingness to receive a COVID-19 vaccine.

This study found that individual-level factors influenced the willingness to receive a COVID-19 vaccine. In line with previous studies,^{8,9,31} individual risk perception affects the willingness to receive COVID-19 vaccines. A perception of a lack of necessity or urgency to be vaccinated was reported among the Taiwanese and Haitian participants. Furthermore, they explained that they perceived a low risk of contracting COVID-19 and had a sense of security by staying in their countries due to the relatively low number of cases and deaths due to COVID-19.

Taiwan was successful in controlling the spread of COVID-19 before May 2021; therefore, the Taiwanese participants perceived that it was unnecessary or urgent to get vaccinated when this study was conducted. However, after the COVID-19 outbreak in May 2021 in Taiwan, most Taiwanese people rushed to get a COVID-19 vaccine since individual risk perception changed due to the development of the COVID-19 epidemic in Taiwan. To date, over 70% of the Taiwanese population has received two doses of COVID-19 vaccines.³ Additionally, COVID-19 in Haiti remains a mystery; the Haitian participants also perceived that it is unnecessary to receive a COVID-19 vaccine since the COVID-19 situation was not severe in Haiti. However, the low number of COVID-19 cases and deaths in Haiti might be due to a very limited testing capacity and unreliable real-time surveillance. Health education campaigns can raise awareness of the threat of COVID-19 and the importance of getting a COVID-19 vaccine.

Regarding beliefs and attitudes concerning health and prevention, the Taiwanese and Haitian participants reported a preference for natural immunity and adopting precautionary measures other than vaccination likely because they believed that there are other ways to prevent COVID-19 (e.g., natural immunity or mask-wearing); thus, vaccination was considered an unnecessary preventive measure. It is important to educate people that vaccine-induced immunity is safer than natural immunity against COVID-19. Additionally, this study revealed that a lack of knowledge regarding COVID-19 vaccines was stated by the Taiwanese, U.S., and Haitian participants. A lack of knowledge regarding COVID-19 vaccines contributes to hesitation and refusal to vaccination. This finding is aligned with previous studies.^{13,32} As Ratzan and Parker (2020) highlighted,³³ vaccine literacy is key to helping people decide to accept a COVID-19 vaccine. Educational interventions aiming to build vaccine literacy are critical to resolving COVID-19 vaccine hesitancy.

This study identified that communication and the media environment could determine COVID-19 vaccine hesitancy. Regarding misinformation and rumors, misinformation was found among a few Taiwanese and Dutch participants. Additionally, rumors concerning COVID-19 vaccines were mentioned by the Dutch and Haitian participants. It is a great concern that rumors concerning COVID-19 vaccines circulated in the Netherlands and Haiti. Clarifying misinformation and rumors regarding COVID-19 vaccines through better vaccine education is also needed to improve public acceptance of receiving a COVID-19 vaccine. Furthermore, a lack of verified information was stated by the participants in all four countries, indicating that proper vaccine communication is critical for improving vaccine hesitancy.

Regarding anti-vaccination lobbies, the U.S. and Dutch participants reported a small group of anti-vaxxers against COVID-19 vaccination in their countries. Notably, anti-vaxxers usually spread conspiracy theories concerning COVID-19 and vaccines, which might endanger the COVID-19 vaccination rates. Regarding historical influences, the U.S. and Haitian participants reported that the black community might be hesitant about or refuse vaccination due to past unethical research practices, which is consistent with previous studies.^{10,18,34} Vaccine campaigns tailored to racial subgroups are warranted to reduce vaccine hesitancy.

Regarding vaccine/vaccination-specific issues, this study revealed that fear or caution regarding vaccine uptake was reported by the Taiwanese and U.S. participants. Previous studies^{10,35} have suggested that fear of vaccines or injections might play a role in contributing to COVID-19 vaccine hesitancy. Additionally, the need for multiple doses of the COVID vaccines might be a barrier preventing people from getting vaccinated. Needle-free vaccine delivery routes (e.g., nasal sprays or skin patches) and a single-administration with timed-release formulations can be developed or available in future vaccination campaigns to decrease vaccine hesitancy.³⁶ Regarding new vaccines, the participants in all four countries reported that COVID-19 vaccines are new and that there are many unknowns regarding COVID-19. They were skeptical of new vaccines and preferred to wait and see whether vaccinated people stay healthy after vaccination. Vaccine education tailored to hesitant people can resolve their concerns or worries regarding COVID-19 vaccines to increase their willingness to receive vaccination.

Limitations

Although this study was conducted with care, there are some potential limitations. First, it included only small samples from Taiwan, the United States, the Netherlands, and Haiti. Therefore, the results might be biased and are not necessarily representative of these four countries. Despite the relatively small sample sizes, the investigators attempted to capture diverse opinions and perspectives regarding COVID-19 vaccine hesitancy from the small sample. Second, both in-person interviews and online interviews were used in this study, and the different interview methods might have affected the quality of the data. However, the investigators attempted to use video-recording under the participants' permission to record non-verbal data to reduce the impact on the quality of the data. Third, this study was carried out from November 2020 to March 2021, and the attitudes and willingness regarding COVID-19 vaccine uptake might have changed among the participants as the COVID-19 situation continued to change in each country over time. In particular, Taiwan recently faced its first major COVID-19 surge since May 2021, and greater numbers of Taiwanese people have perceived the importance of getting a COVID-19 vaccine. This was highlighted in the discussion part. Fourth, the findings of the four countries themselves are not comparable with each other as the contexts differ substantially in nature. However, this qualitative study shed light on the similarities and differences of the determinants of COVID-19 vaccine hesitancy in different sociocultural contexts. These findings might help in improving COVID-19 vaccination in these four countries.

Conclusions

In general, the current study suggests that vaccine hesitancy exists among participants in Taiwan, the United States, the Netherlands, and Haiti. Building trust in the COVID-19 vaccine, cultivating vaccine literacy, clarifying misinformation and

rumors regarding COVID-19 vaccines, and providing verified information are critical for increasing public acceptance of getting a COVID-19 vaccine.

Implications and future research direction

First, a lack of knowledge regarding COVID-19 vaccines can contribute to vaccine hesitancy as highlighted in this study. The knowledge, attitude, and practice (KAP) model can be used to explain why people are hesitant to receive a vaccine. Educational intervention tailored to cultivate vaccine literacy can improve public acceptance of COVID-19 vaccines. Future research can be carried out to examine the relationship among knowledge, attitude, and COVID-19 vaccination behavior. Second, this study found that people lack verified information regarding COVID-19 vaccines to make the decision. The pharmaceutical industry and government entities should provide transparent and understandable data, including a timeline of the development of COVID-19 vaccines, the safety and effectiveness of COVID-19 vaccines, testing in different groups (based on age, ethnicity, gender, chronic diseases, etc.), the timeline of vaccine approval and the approval process to resolve the concerns of those who are hesitant regarding being vaccinated or refuse to be vaccinated. Future research can investigate how information plays a role in individual decision-making regarding vaccination. Third, anti-vaccination lobbies might play a role in influencing people's willingness to become vaccinated; however, very few studies explored this topic. Future research can investigate how anti-vaxxers affect vaccination in society.

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Data availability

At the time of the data collection, the participants did not consent to have their full transcripts shared publicly. We are, therefore, unable to provide access to the raw data. The data are, however, available from the authors upon reasonable request.

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