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RESEARCH ARTICLE

Vaccine hesitancy and its determinants among refugee parents resettled in Aotearoa New Zealand

Mulisa Senbeta Debela[a], A. P. Nick Garrett[b], and Nadia A. Charania [a,c]

[a]Department of Public Health, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; [b]Department of Biostatistics and Epidemiology, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; [c]Migrant and Refugee Health Research Centre, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand

ABSTRACT

Vaccine hesitancy is an important factor underpinning suboptimal vaccine uptake and evidence on marginalized subgroups, such as refugees, is limited. This cross-sectional survey was conducted in 2020/21 with former refugee parents who resettled in Aotearoa New Zealand (NZ). The Parent Attitudes about Childhood Vaccines (PACV) was offered in Somali, Oromo, Arabic, and English languages, and the reliability of the four versions were evaluated. The prevalence of parental vaccine hesitancy was explored and the association between vaccine hesitancy and sociodemographic factors was examined using logistic regression. One hundred and seventy-eight responses were included in the analysis. The Cronbach's alpha scores for Somali, Oromo, Arabic, and English PACV were 0.89, 0.64, 0.53, and 0.77, respectively. The rate of parental vaccine hesitancy was 16.3%, 95% CI (10.7, 21.3). Most caregivers were concerned about vaccine side effects (47%), safety (43%), and efficacy (40%). Less than a quarter (21%) of parents had delayed their child receiving a vaccine and 12% had refused to vaccinate their child for reasons other than medical exemptions. After adjusting for covariate/s, parents' primary source of information and education status were significantly associated with vaccine hesitancy. Media as a primary source of vaccine information and low education status were associated with higher vaccine hesitancy. Vaccine hesitancy is relatively low among former refugees and is influenced by modifiable factors, including educational level and primary source of vaccine information. Vaccine information tailored to former refugee parents' concerns are required to reduce vaccine hesitancy and improve vaccine uptake.

Introduction

Vaccination is one of the most successful cost-effective public health measures to prevent and control infectious diseases.[1] Vaccines are a human right enabling people to live longer, healthier lives and protecting against infectious disease outbreaks can save money and improve a country's productivity and resilience.[2] Projected vaccine coverage for 2016–30 revealed how vaccination programs can reduce mortality and medical impoverishment in low- and middle-income countries, particularly those in the poorest quintiles thereby improving health equity and reducing poverty.[3] Yet, millions of children miss out annually on the benefits of vaccines, including reduced mortality and burden from vaccine-preventable diseases (VPDs).[1] The main goals of national immunization programs are to provide direct protection for individuals and indirect protection for communities through herd immunity.[4,5] Therefore, the success of immunization programs rely on high coverage rates both at national and subnational levels.[6] Today, vaccine hesitancy has been observed in over 90% of the countries worldwide.[7,8] Vaccine hesitancy can undermine vaccine demand and lead to suboptimal coverage thereby increasing the risk of resurgence of VPDs.[6]

The term 'vaccine hesitancy' has not been used consistently in the literature. The most common understanding of vaccine hesitancy comes from the World Health Organization (WHO) that defined it as a "delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence."[6] Given that the focus of this definition is on an individual's vaccination behavior (i.e., delay or refusal), it can overlook broader systemic barriers to vaccine access and the distinction between vaccine beliefs and behaviors.[9] Thus, a recent definition refers to vaccine hesitancy as "a motivational state of being conflicted about or opposed to getting vaccinated" without reference to vaccination behavior.[9] Vaccine hesitant parents (VHPs) are a heterogenous group who may accept some vaccines and refuse others; they may delay receipt of vaccines or accept them according to the recommended national schedule while being unsure.[10]

There were at least 82.4 million people forcibly displaced worldwide at the end of 2020.[11] Of these, 26.4 million were

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refugees, and around half of these refugees were children under the age of 18 years old.[11] As per Aotearoa New Zealand's human rights framework, the country has been hosting refugees since World War II and accepts refugees under various pathways, including the refugee quota program (recently increased up to 1500 annually), the refugee and protection programme (asylum seekers who are referred to as convention refugees if their claim is successful), the family reunification scheme (recently increased up to 600 annually) and the newly introduced community organization refugee sponsorship program. It has been estimated that the number of refugees resettled in New Zealand since the World War II is approximately 50,000, most of whom enter as part of the quota refugee program, which represents 1% of the New Zealand population.[12,13] Resettled refugees in New Zealand represent numerous nationalities that have changed over time depending on worldwide events.[12] Most recently, quota refugees primarily arrive from Afghanistan, Colombia, Myanmar, and Syria.[14]

All refugees are eligible for publicly funded health services aligned with the New Zealand Public Health and Disability Act 2000, and children under 18 years of age are eligible for Well Child/Tamariki Ora services.[15–17] The New Zealand Refugee Resettlement Strategy outlines a holistic approach to deliver and improve resettlement outcomes.[18] More specifically, the Strategy is underpinned by five integration outcomes, including self-sufficiency, housing, education, health and wellbeing, and participation.[18] Currently, the Strategy only includes quota refugees and only quota refugees are offered an orientation program; however, the Strategy is currently under review and will hopefully include all refugees in the future.[18]

Migrants and refugees generally experienced higher VPD burden, yet lower reported vaccination coverage rates compared to their host populations due to various contributing factors.[19] When investigating the relative contribution of factors on sub-optimal coverage among migrants, having a recent migration history and being a refugee or asylum seeker were two of the significant determinants.[20] Children with refugee backgrounds are at risk of being under-immunized given their lack of access to vaccination in their countries of origin, while they are on the move (in transit countries) [21] and even long after they have resettled in the host countries.[22] Complete and timely immunizations for VPDs is imperative to protect refugee children's health and wellbeing and reduce health disparities, yet refugee children entering New Zealand were reported to be susceptible to VPDs with suboptimal immunity.[23] Also, foreign-born refugee children have high rates of being under-immunized with 87% (n = 285) of children entering NZ on quota visas and 76% (n = 312) of those entering on asylum seeking or humanitarian not having complete and timely vaccination status.[24]

To meet the goals of the World Health Organization's Immunization Agenda 2030, national immunization policies and programs need to include the needs of children with migrant and refugee backgrounds.[2] While every child, regardless of immigration status, are entitled to publicly funded routine vaccines on the National Immunization Schedule in NZ,[15] only quota refugees are offered additional support upon arrival to assess their vaccination status during an orientation program. Moreover, the New Zealand Refugee Resettlement

Strategy currently includes a health outcome goal to increase uptake of age-appropriate vaccinations among quota refugee children post-arrival.[18] If an immunization program is available and efforts are directed to reduce access barriers yet immunization services remain underutilized, vaccine hesitancy could be a contributor to low acceptance of vaccines.[22] Therefore, whether vaccine hesitancy contributes to low coverage among former refugee children in NZ warrants investigation.

Studies on vaccine hesitancy underscore the importance of utilizing a valid and reliable survey.[6,10,25] The Parent Attitudes about Childhood Vaccines (PACV) is one of the validated survey tools that has been specifically developed for routine vaccinations.[10] The PACV survey has been widely used by researchers to assess vaccine hesitancy.[26] The PACV was also useful to predict children's risk of under-immunization, especially among parents with high hesitancy scores.[27] It has been translated to different languages and available in Malay, Arabic and Spanish versions.[27–30] As the survey has mostly been used among mainstream societies, the performance of the PACV in other minority languages is currently unknown.

Thus, the aims of this study are to: (i) assess the prevalence of parental vaccine hesitancy among former refugees resettled in NZ; (ii) examine the association between vaccine hesitancy and sociodemographic factors; and (iii) evaluate the reliability of the PACV survey in Somali, Oromo, Arabic, and English.

Materials and methods

Population and sampling

A cross-sectional study design drawing from a post-positivist research paradigm was used to collect data from former refugee parents. Participants were eligible to participate if they identified as being a former refugee who lived in NZ for at least 6 months and was an adult (18 years or older) who was the parent or legal guardian of a child between 6 weeks and 16 years old. As part of the National Immunization Schedule, children are offered vaccines from 6 weeks of age to 12 years old to protect against various diseases including measles, pertussis, and tetanus, to name a few.[15]

The sample size was based on a previous study that noted that 31.5% of New Zealanders were either skeptical or strongly opposed a statement about the safety of vaccinating children according to the National Immunization Schedule.[31] Utilizing PASS software version 13 (www.ncss.com) and with the estimated hesitancy proportion of 31.5%, a sample size of 150 will enable that with 95% confidence we can estimate hesitancy with ±0.08.[32] With a sample size of 150 and a reference proportion of 31.5% an odds ratio of 1.64 would be statistically significant with 95% confidence and 80% power.[33]

PACV survey

The PACV survey has 15 items grouped into three domains. The first domain is a behavioral domain (items 1 and 2); the second domain is safety and efficacy (items seven–10); and the third domain is general attitude and trust about vaccines and vaccination services (items three–six and 11–15).

The PACV score was assigned for the 15 non-demographic items and converted according to the guidelines published by Opel et al.[10] A score of zero was assigned to non-hesitant answers (i.e., "not at all hesitant" or "not too hesitant"); one was assigned to neutral answers (i.e., "don't know" or "not sure"); and two was assigned to hesitancy responses (i.e., "somewhat hesitant" or "very hesitant"). As suggested by Opel et al.[10] we used a linear equation that accounts for missing data when converting a raw score between zero and 30 to the score between zero and 100. All responses with more than three missing items were excluded from the analysis. Following previous literature, PACV scores were then dichotomized into hesitant (score ≥50) and non-hesitant (score <50).[27,28,30]

The instructions asked parents to consider general childhood vaccines (not including seasonal influenza or influenza A/H1N1 vaccines as per[10]) and if they had multiple children, to answer the questions for their child with the next birthday. Some demographic questions were added to the PACV questionnaire, including firstborn status of the child, relation to the child, number of children in the household, family type, parent's age, household income, education, religion, duration of residence in NZ and region of their country of origin. Parents were also asked about their primary source of vaccine information and if their child(ren) were age-appropriately immunized. Lastly, an open-ended question asked if parents had any additional comments about childhood vaccinations.

PACV survey translations

The PACV was made available to participants in English, Somali, Oromo, and Arabic to accommodate some of the language preferences of refugee populations resettled in NZ (please see supplementary materials). These languages were chosen to accommodate some of the main refugee communities that have resettled in NZ with a focus on East African and Middle Eastern countries, including Somalia, Ethiopia, Syria, Iraq, and Afghanistan.[14,34] The adapted English PACV was translated into Somali and Oromo, and reverse translation was done on the validated Arabic version. The translation processes followed the guidelines by Maneesriwongul and Dixon [35] that included forward and backward translations for the Somali and Oromo PACV survey. First, bilingual primary translators carried out the translations from English to Somali and Oromo languages. Then native speakers of each language reviewed the documents. Subsequently, reverse translations to English were done by independent translators who did not know the aim of the survey. Since the Arabic PACV survey was already validated by other authors,[30] only reverse translations from Arabic to English was carried out by a translation service.

A pilot survey was conducted with former refugees to test the clarity and acceptability of the translated PACV surveys. The PACV survey was distributed to 15 people using a link to the online survey and only eight participants responded (Arabic (n = 3), Somali (n = 2) and Oromo (n = 3)). Pilot participants noted that the survey was clear and easy to understand in their respective languages. The Cronbach's alpha score for combined PACV (three languages combined) was 0.74, indicating good internal consistency. Due to the small sample size of participants for the pilot (n = 8), the internal consistency for the PACV in each language was not determined.

Recruitment and data collection

Data collection was done from November 2020 to January 2021. It is important to note that data collection was conducted amidst the COVID-19 pandemic. Thus, the timing may have influenced people's ability to participate given related restrictions, and events surrounding the development and distribution of the COVID-19 vaccines may have affected participant's views on childhood routine vaccinations.

Recruitment focused on the main refugee resettlement locations in NZ at the time of the study, including Auckland, Wellington, Hamilton, Palmerston North, Nelson, Christchurch, Dunedin, and Invercargill. As refugee communities are often considered to be a "hard-to-reach" group, two distribution channels were used to improve the response rate; surveys were available online using Qualtrics (Provo, UT) and as hard copies. The survey link was distributed via posts on various social media platforms (e.g., Facebook, Viber, Imo, Telegram and Whatsapp) on community/group accounts and hard copies of flyers were posted in places people with refugee backgrounds attend (e.g., community centers, mosques, churches) along with hard copies of the survey. In addition, there was a message at the end of the survey that asked participants to share the survey link with others should they wish.

Data analysis

The data were analyzed using Statistical Package for Social Science (IBM SPSS Statistics, version 27). Descriptive analysis was conducted using counts, percentages, means, median and standard deviation. The reliability analysis of the different versions of the PACV survey was done to test the internal consistency.

The bivariate association between each of the categorical variables and vaccine hesitancy was analyzed using a chi-square test (χ^2) of proportion and reported as unadjusted odds ratio with 95% confidence intervals (CI). To allow for confounding effects all the variables with a p-value <.20 in the bivariate models were then included as candidates in the multivariable logistic regression and reduced to the final model using a stepwise-backward elimination method. Only variables with a p-value <.05 were considered significant and results were presented as adjusted odds ratio (OR) with 95% CI.

Ethical considerations

Ethical approval was obtained from the Auckland University of Technology Ethics Committee (20/267). Participation was voluntary and participants provided consent prior to commencing the survey. The survey was anonymous, but enabled participants to enter their contact information separately to enter into a prize draw for five grocery vouchers in appreciation of their participation.

Results

Of the 203 people who attempted the survey, 136 (67%) and 67 (33%) responded to the online and paper survey, respectively. Twenty-five responses (22 online and 3 paper surveys) were excluded because they were only partially completed or did not meet the inclusion criteria. Eventually, 178 participants were included in the final analysis.

Participants' sociodemographic characteristics

A summary of sociodemographic characteristics of participants are shown in Table 1. More respondents were fathers (n = 99, 56%) than mothers (n = 69, 39%) and legal guardians ("other") (n = 9, 5%). Participants between age 35–44 accounted for 34% of the sample, and those 45 years and above constituted 31%. Regarding family type, most were couples with child(ren) (n = 130, 73%), followed by single parents (n = 23, 13%). Approximately half (n = 76, 43%) of parents had three or more children, while the rest of parents had two children (n = 51, 29%) or one child (n = 47, 26%). Almost all participants identified as either Muslim (n = 91, 51%) or Christian (n = 83, 47%). In terms of education, most participants (92%) had either trade, secondary or tertiary-level qualifications. About half of parents (53%) had an annual household income of below NZ$50,000. Over half (62%) of participants had lived in NZ for more than 10 years. Most of the participants were of African origin (n = 123, 70%), followed by parents from the Middle East (n = 31, 18%) and Asia (n = 15, 9%) regions. The remaining were from other regions, including the Pacific/Oceania, Europe, Latin America and Caribbean, and North America regions (n = 6, 3%).

Vaccine hesitancy outcome data

Reliability of PACV survey

The internal consistency of the combined PACV surveys and each of the four languages were tested (Table 2). The Cronbach's alpha score for combined PACV (four languages combined) was 0.77. The individual Cronbach's alpha score for Somali, Oromo, Arabic, and English PACV were 0.89, 0.64, 0.53 and 0.77 respectively. Despite being previously validated, the Arabic PACV survey had the lowest Cronbach's alpha coefficient in this study.

Prevalence of vaccine hesitancy, vaccination status and sources of vaccine information

The minimum PACV score in this study was zero and the maximum was 90. The mean, median and standard deviation for the PACV score were 31.8, 30, and 17.6 respectively. The prevalence of parental vaccine hesitancy among former refugees in NZ was 16.3%, 95% CI (10.7, 21.3). This was less than the self-reported vaccine hesitancy rate (item 12) which was 24%.

The majority of parents (80%) reported that their children were age-appropriately immunized, while 10% of parents reported that their children were not age-appropriately immunized and the remaining 10% were unsure. More parents had delayed their child receiving a vaccine (n = 34, 21%) than parents who decided not to vaccinate their child (n = 19, 12%) for reasons other than medical exceptions. A small percentage of parents would not vaccinate their child as per the recommendations if they had another infant (n = 16, 6%). Results from Chi-square showed 17 (63%) of hesitant parents had delayed vaccines for their children versus 17 (12%) of non-hesitant parents (p < .001). Furthermore, 12 (46%) of hesitant parents had refused a vaccine for their child for reason other than medical exemptions versus 7 (5%) of non-hesitant parents (p < .001).

Almost half of parents were concerned about the side effects of vaccines (n = 83, 47%) while less than half were concerned about the safety of vaccines (n = 75, 43%) and efficacy (n = 69, 40%) (Table 3). More than three-quarters of parents (79%) believed that VPDs are severe, yet more than half (53%) thought it was better to develop natural immunity or were unsure. Over half of parents (58%) thought their child received more vaccines than are good for them and about one-third (35%) wanted children to receive fewer vaccines at the same time (Table 3).

Most parents (88%) indicated some trust in their children's doctors and 86% agreed that they could discuss concerns about childhood vaccines with doctors. Most caregivers (83%) also trusted information they received about childhood vaccines. For the additional question related to primary source of vaccine information, three-quarters of parents considered official sources, such as health professionals (doctors and nurses) and brochures, as their primary sources of information. Other parents (12%) turned to media sources (e.g., internet, tv, radio, and social media platforms) and 6% of parents turned to family, friends, and their community for information. As the paper-based copy enabled multiple choices, 9% of parents reported turning to multiple sources for vaccine information.

Association between sociodemographic determinants and vaccine hesitancy

The bivariate logistic model outcomes demonstrated source of information had a significant association with vaccine hesitancy (p = .03). Parents who used media (mass media and electronic media) as a primary source of vaccine information were three times more likely to be hesitant than those who used official sources (health professionals and brochures) as a primary source of vaccine information, OR = 3.20, 95% CI (1.07, 9.58). Other variables including first-born status, age, religion, income, and duration of residence in New Zealand were not significantly associated with vaccine hesitancy (Table 4).

In the multivariate model, after adjusting for education, primary source of information remained significantly associated with vaccine hesitancy (p = .045). Parents who used media (mass media and electronic media) as their primary source of vaccine information were about five times more likely to be hesitant compared to parents who accessed official sources (health professionals and brochures), OR = 4.87, 95% CI (1.36, 17.38) (Table 4).

Another determinant after controlling for source of information that had a significant association with vaccine hesitancy was education (p = .04). Parents with primary education were almost

Table 1. Sociodemographic characteristics of participants (n = 178).

	Number	Valid Percent
Parent		
Father	99	56%
Mother	69	39%
Other	9	5%
Missing	1	
First-born status		
Yes	90	51%
No	86	49%
Missing	2	
Age		
18–24	12	7%
25–34	49	28%
35–44	61	35%
45+	55	31%
Missing	1	
Family type		
Couple	130	73%
Single parent	23	13%
Extended family	19	11%
Other	4	2%
Missing	1	
Number of children		
One	47	27%
Two	51	29%
Three and above	76	44%
Missing	4	
Religion		
Christian	83	47%
Muslim	91	51%
Other	3	2%
Missing	1	
Educational level		
No qualification	7	4%
Primary	7	4%
Secondary	40	23%
Trade/Vocational	39	22%
University	82	47%
Missing	3	
Household income, NZ$		
< $25,000	29	18%
$25,001– $50,000	58	35%
$50,001 – $75,000	52	31%
> $75001	27	16%
Missing	12	
Duration in NZ		
< 1 year	2	1%
2–4 years	22	12%
5–9 years	44	25%
>10 years	109	62%
Missing	1	
Region of origin		
Africa	123	70%
Asia	15	9%
Middle East	31	18%
Other*	6	3%
Missing	3	

*Other = Pacific/Ocenia region, Europe, Latin America and Caribbean and North America. NZ$ = New Zealand dollar.

nine times more likely to be vaccine hesitant than parents with tertiary education, OR = 8.97, 95% CI (1.48, 54.33). Moreover, compared to parents with tertiary qualifications, parents with secondary education were nearly three times more likely to be vaccine hesitant, OR = 2.9, 95% CI (1.02, 8.29) (Table 4).

Comments about childhood vaccinations

Twenty-seven people (15%) responded to the last question of the survey, which was an open-ended question that asked, "Do you have any additional comments about childhood vaccinations?"

Table 2. Internal consistency of PACV surveys in different languages.

		Reliability score		
	Number	Cronbach's Alpha	Cronbach's Alpha (Standardised Items)	N of Items
English PACV	109	0.76	0.77	15
Somali PACV	10	0.89	0.89	15
Oromo PACV	18	0.62	0.64	14*
Arabic PACV	17	0.58	0.53	15
Combined PACV	154	0.77	0.77	15

*The Oromo PACV was only 14 items because there was no variation in the responses to Q14.

Of the 27 responses received, 24 pertained to vaccines and vaccination services (Table 5). Nearly half of the respondents (44%) displayed positive beliefs in vaccination with participants noting the benefits of vaccines in protecting children from diseases and the importance of vaccines in reducing infant mortality rates.

> Vaccination is highly important for all kids in the world. (Respondent #9)

Slightly less than half of participants (41%) noted concerns related to the safety and efficacy of vaccines. Some parents raised concerns that vaccines cause behavior changes in children and that natural immunity is superior. Importantly, one participant noted the racism and discrimination present within the NZ health care system and how this impacts refugees' access to and utilization of health services, including their perceptions of vaccinations. The participant wrote that:

> The health care system fails to adequately care and support those who are nonwhite, this in turn creates a significant doubt and mistrust of the health care providers and professionals. Racism and discrimination are the main reasons for refugees to be blatantly subjugated to mistreatment and poorer health outcomes and experiences. To put it bluntly, you can't trust those who mistreat you when you are vulnerable and at their mercy for help and support. Hence the surge of anti-vaccination sentiments amongst refugees. (Respondent #47)

Given these concerns, some participants noted the need for more research about vaccines and parental education about the side effects and benefits of vaccination in the language of the parents to improve comprehension.

Discussion

Vaccine hesitancy and its determinants

To the authors' knowledge, this is the first national study to explore parental vaccine hesitancy and its determinants among the former refugee population. Using the PACV survey, the prevalence of vaccine hesitancy among former refugee parents resettled in NZ was 16%. Previous literature reported that 31.5% of the general population who completed the 2013/14 New Zealand Attitudes and Values Study (NZAVS) survey expressed a degree of concern regarding the safety of childhood vaccinations.[31] Moreover, attitudes toward the safety of childhood vaccinations from 2013 to 2017 using the NZAVS demonstrated that the public's attitudes are becoming more polarized with 30% expressing decreased confidence compared to only 10% whose confidence increased over time (with the remaining 60% maintaining strong vaccine confidence).[36]

Table 3. Responses to PACV survey items (n = 178).

Question Number	PACV Questions	Response	No. (%)
1	Have you ever delayed having your child get a vaccine (not including seasonal flu or swine flu (H1N1) vaccines) for reasons other than illness or allergy? *	Yes	34 (21)
		No	131 (79)
		Don't know	13
2	Have you ever decided not to have your child get a vaccine (not including seasonal flu or swine flu (H1N1) vaccines) for reasons other than illness or allergy? *	Yes	19 (12)
		No	142 (88)
		Don't know	17
3	How sure are you that following the recommended vaccination schedule is a good idea for your child? Please answer on a scale of 0 to 10, where 0 is Not at all sure and 10 is Completely sure.	0 – 5	29 (17)
		6 – 7	30 (18)
		8 – 10	110 (65)
		Missing	9
4	Children get more vaccines than are good for them.	Agree	102 (58)
		Disagree	27 (15)
		Unsure	48 (27)
		Missing	9
5	I believe that many of the illnesses that vaccines prevent are severe.	Agree	137 (79)
		Disagree	22 (12)
		Unsure	15 (9)
		Missing	4
6	It is better for my child to develop immunity by getting sick than to get a vaccine.	Agree	45 (26)
		Disagree	82 (47)
		Unsure	46 (27)
		Missing	5
7	It is better for children to get fewer vaccines at the same time.	Agree	60 (35)
		Disagree	52 (30)
		Unsure	61 (35)
		Missing	5
8	How concerned are you that your child might have a serious side effect from a vaccine?	Concerned	83 (47)
		Not concerned	77 (44)
		Unsure	16 (9)
		Missing	2
9	How concerned are you that any one of the childhood vaccines might not be safe?	Concerned	75 (43)
		Not concerned	72 (42)
		Unsure	26 (15)
		Missing	5
10	How concerned are you that a vaccine might not prevent the disease?	Concerned	69 (40)
		Not concerned	71 (41)
		Unsure	32 (19)
		Missing	6
11	If you had another infant today, would you want him/her to get all the recommended vaccines?	Yes	151 (85)
		No	16 (6)
		Don't know	11 (9)
		Missing	0
12	Overall, how hesitant (uncertain) about childhood vaccines would you consider yourself to be?	Hesitant	43 (24)
		Not hesitant	113 (65)
		Unsure	20 (10)
		Missing	2
13	I trust the information I receive about vaccines.	Agree	146 (83)
		Disagree	19 (11)
		Unsure	12 (7)
		Missing	1
14	I am able to openly discuss my concerns about vaccines with my child's doctor.	Agree	149 (86)
		Disagree	13 (8)
		Unsure	12 (7)
		Missing	4
15	All things considered, how much do you trust your child's doctor? Please answer on a scale of 0 to 10, where 0 is Do not trust at all and 10 is Completely trust	0 – 5	18 (12)
		6 – 7	30 (19)
		8 – 10	107 (69)
		Missing	23

Highlighted responses indicate hesitancy; Q1–Q15 responses were collapsed from 5 into 3 categories; *don't know in Q1 and Q2 excluded as missing data.

Most of the respondents identified as being from the African region. In African countries, vaccine hesitancy is posing a challenge to the substantial progress made by expanded immunization programs.[37] Various vaccination controversies (e.g., boycott of the polio vaccine in northern Nigeria in 2003) have resulted in people delaying or refusing recommended vaccines thereby increasing the potential for infectious disease outbreaks.[38,39] The nature and extent of vaccine hesitancy in African countries is hard to discern as there is limited research available and tools developed to measure vaccine hesitancy, including the PACV, were developed in high-income countries and have yet to be validated in Africa.[37] Vaccine hesitancy is highly context-dependent;[40] thus, it is imperative that more research is conducted given the diverse sociocultural beliefs and practices across Africa as a continent.[37]

Elsewhere, studies that used the PACV survey amongst the general population found a vaccine hesitancy prevalence ranging from 5.8% in Bahrain [41] to 34.7% in Italy.[42] Studies that used the Vaccine Hesitancy Scale (VHS) found a prevalence

Table 4. Association between sociodemographic factors and vaccine hesitancy.

Factor	Hesitant No.	Non-Hesitant No.	Bivariate Analysis UOR (95% CI)	P	Multivariate Analysis AOR (95% CI)	P
First-born status						
Yes	13	77	1.35 (0.61, 3.01)	0.45		
No	16	70	REF			
Age	21	89	1.68 (0.609, 4.63)	0.60		
18–34						
35+	17	99	REF			
Religion						
Christian	9	74	REF	0.16		
Muslim	19	72	2.17 (0.92, 5.11)			
Other**	1	2	4.11 (0.34, 49.99)			
Education						
No qualification	2	5	3.70 (0.62, 22.27)	0.08	4.69 (0.45,48.90)	0.04*
Primary	3	4	6.94 (1.31, 36.68)		8.97 (1.48,54.33)	
Secondary	9	31	2.69 (0.95, 7.60)		2.91 (1.02,8.29)	
Tertiary	14	107	REF		REF	
Duration in NZ						
<9 years	14	54	0.90 (0.238, 3.374)	0.21		
>10 years	15	94	REF			
*Source of information ***|						
Official †	18	115	REF	0.03*	REF	0.045*
Media †	6	12	3.20 (1.07,9.58)		4.87 (1.36, 17.38)	
Personal †	4	7	3.65 (0.97,13.74)		2.25 (0.32, 15.85)	
Household income, NZ$						
< $25,000	6	23	1.15 (0.31,4.31)	0.67		
$25001– $50,000	11	47	1.03 (0.32,3.33)			
$50001 – $75,000	6	46	0.57 (0.16, 0.09)			
> $75001	5	22	REF			

Note. NA: Not applicable; UOR: unadjusted odds ratio; AOR: adjusted odds ratio; * Significant result, p < .05; **Other: Hindu, Buddhist, Atheist, and other religion.
*** only 162 participants with single primary source of information were included; † Official: health professionals and brochure; Media: mass media (tv and radio). social media, internet (google); Personal: family and friends, community, and other. NZ$ = New Zealand dollar

among parents ranging from 1.1% in Guatemala [25] to 46% among parents of children between 1–15 years old in France.[43] Moreover, a cross-sectional study in China among parents under 6 years old used a survey-based confidence in childhood vaccine safety and efficacy and health professionals, and reported that over half of caregivers (60%) expressed some hesitancy.[44] Besides the different tools used to measure vaccine hesitancy, variations in prevalence can be attributed to multidimensional factors, including individual/group factors (e.g., preventative health beliefs and attitudes), vaccine-related factors (e.g., types of health systems and immunization programmes), and contextual factors (e.g., wider socioeconomic and cultural contexts).[40] Previous literature has noted various factors that influence vaccine access and acceptance among migrants and refugees, including language barriers.[45–49]

Timely vaccinations are important to protect children against VPDs.[15] In this study, 1 out of 5 parents delayed their child's vaccines for reasons other than medical allergy. While vaccine hesitancy may contribute to this finding, gaps in accessibility may also explain this finding as migrants and refugees can experience inequities in the provision of preventative health services, including vaccinations.[50,51] In New Zealand, although childhood vaccines are freely available, navigating an unfamiliar health care system can hinder refugees' ability to access and utilize publicly available health care services.[52,53] Moreover, at an organizational and structural level, literature has called for additional support for general practices and providers to improve immunization timeliness.[54,55] These supports will be particularly important to improve services for refugees as providers have noted substantial barriers to

vaccinating people with refugee backgrounds.[56,57] Ensuring that refugee families have equitable access to vaccination services may also support complete and timely vaccinations among refugee children.

Surveyed parents were concerned about vaccine side effects (47%), safety (43%), and efficacy (40%). Similarly, the most frequently cited concerns among the general population in New Zealand were the risk of side effects (52%), vaccines are upsetting/painful for children (safety) (30%), and vaccines are unnecessary as the diseases are not around (8%).[36] Several studies also reported that vaccine side effects, safety and efficacy are the top parental concerns about childhood vaccines.[28,30,42,58]

In this study, education and primary source of vaccine information were found to be significantly associated with vaccine hesitancy. In a NZ study, parents among the general population with higher educational status exhibited greater confidence in childhood vaccine safety than those with lower educational status.[31] However, the role of education in parental vaccine hesitancy is inconclusive in literature. According to a systematic review by Larson et al.[26] parental education was positively correlated with vaccine confidence in some countries such as Greece and the Netherlands, but in other countries including China, Lebanon, Israel, Bangladesh, and USA, higher education was a potential barrier to vaccine acceptance. The paradox of educational success in vaccine acceptance could be explained by the concept of "healthism" which says that vaccine hesitancy is associated with high education attainment because parents who succeeded in education might think they can replicate the same control over their own health or their

Table 5. Respondents' comments pertaining to childhood vaccines and vaccination services (n = 24).

Participant Number	Comments about childhood vaccines and vaccination services
R9	Vaccination is highly important for all kids in the world.
R12	I am not sure how important having child vaccine is. it is very hard to see when your child cried during vaccine.
R20	Vaccination is vital for our children to prevent them from disabilities or untimely death.
R38	In opinion vaccinations affect the behavior of children.
R47	The health care system fails to adequately care and support those who are nonwhite, this in turn creates a significant doubt and mistrust of the health care providers and professionals. Racism and discrimination are the main reasons for refugees to be blatantly subjugated to mistreatment and poorer health outcomes and experiences. To put it bluntly, you can't trust those who mistreat you when you are vulnerable and at their mercy for help and support. Hence the surge of anti vaccination sentiments amongst refugees.
R51	Be natural as much as possible
R55	People come to New Zealand from different part of the world mainly under Quota Refuge and some people from some countries may not know well the value of vaccination and they should be taught well at the reception center.
R56	Vaccination is necessary for children . . . . But there are some vaccinations that may have side effects, negatively affect children's abilities such as speech and comprehension.
R62	There are many children in the world who are far from getting access for vaccines and they lived healthy life, that makes me to think twice about vaccines.
R71	Vaccines can prevent polio, measles, and all diseases, this is important for children because the child cannot tell the signs and symptoms of pains.
R72	I believe that childhood vaccination has reduced infant mortality rate significantly.
R74	I believe that childhood vaccinations have reduced infant mortality rate significantly as in the case of Africa.
R76	There are rumors from community friends that some vaccines cause mental illnesses to children later in their life, and they are giving examples of some children they know they were normal until they had vaccine.
R85	I do agree with childhood vaccination, and it is important for our children
R88	I believe that Vaccination can save many children death and disability. More research and health education can help to improve refuge familys health.
R90	I believe the safety and efficiency of vaccines is not satisfying looking at how much the world developed.
R111	Additional vaccines needs to be added, for example COVID 19 vacines
R113	Health professionals must give the parents the right information of the benefit and side-effects of the vaccination
R128	More education for parents during the prenatal follows up in the language those parents understand.
R137	I agree with children's vaccination
R140	Further investigation should be done on vaccines before it is given and affects the future of the children
R141	The side-effects (a possibe harms of vaccines) should be explained to the parents
R145	COVID has shown the importance of vaccine.
R165	I'm not sure how this vaccination important to my children every single winter they are sick even when travel to home country (Africa), where is the importance of this vaccine

children's health without vaccines.[59] No other vaccine hesitancy studies to date have specifically focused on parents of refugee backgrounds; thus, the influence of education as a determinant of vaccine hesitancy warrants further research among refugee populations.

The primary source of vaccine information was another factor that showed significant correlation with vaccine hesitancy among refugee parents. Parents who used media, including the internet, tv, radio, and social media platforms, as their primary source of vaccine information were about five times more hesitant to vaccinate than parents who considered an official source (health professionals and brochures) as their primary source of vaccine information. Similarly, a study among parents in China, reported higher vaccine hesitancy amongst parents who reported using multiple sources or media sources for vaccination information.[44] In contrast, while parents among the general population in Saudi Arabia also had low rates of vaccine hesitancy (11%) using the PACV survey, there was no significant association between high educational level or social media exposure with vaccine hesitancy.[60] A previous review noted the influence of online and social media on the public's vaccination attitudes;[61] thus, more research is needed to further explore the nuanced role of media on vaccination attitudes among former refugees, particularly given influence of transnationalism on migrants' health and behaviors.[62]

The positive association between vaccine confidence and health professionals as a source of vaccine information has been widely reported in the previous studies.[44,63,64] Generally, information from professional sources can improve vaccination awareness and positively shape perceptions of vaccine acceptance.[42] Literature has noted the value of approaches health professionals can use to positively influence vaccine acceptance among vaccine-hesitant parents, including using a presumptive communication, motivational interviewing, and tailoring information.[65] Future research should explore whether these techniques would be appropriate to use for parents of refugee backgrounds or if other approaches may be more suitable.

Vaccine hesitancy among former refugee caregivers in this study was determined by interrelated and modifiable factors, educational status and primary source of information. As access to formal education is a long-term strategy, a targeted vaccine literacy coupled with effective communication should be considered by health professionals to overcome vaccine hesitancy among former refugees. Change in knowledge rather than change in anti-vaccine attitudes is required to promote vaccination culture in the societies.[66] Since vaccine literacy goes beyond improving knowledge,[67] it is important to embrace former refugees' values in vaccine education. Some value-based vaccination interventions have been effective in shifting perception of parents' acceptance of vaccines.[68] For example, a communication strategy that was supported by religious leaders were effective in shifting negative view of vaccines among minorities.[68,69] Therefore, both health and vaccine literacy through value-based health education is important to reduce vaccine hesitancy and improve vaccine acceptance among former refugees.

Performance of the translated PACV surveys

Assessing vaccine hesitancy across diverse cultural settings is imperative and our study revealed that the combination of the four PACV surveys in Somali, Oromo, Arabic, and English used in this study was reliable. The total Cronbach's alpha score was 0.77, suggesting very good internal consistency. This report was comparable with both the original author's report [10] and other authors' reports regarding the translated versions.[28,30] Therefore, the general reliability of the PACV survey in four languages indicated its potential to assess vaccine hesitancy in diverse languages. Also, all individual PACV surveys, except the Arabic survey, scored acceptable-to-excellent internal consistency in the presented study and was comparable to previous literature.[10,42] Our findings suggest that the PACV surveys in Somali and Oromo can be used to assess vaccine hesitancy in the respective communities. However, the Arabic version may require further revision in accordance with the dialects of a target population. In this study, Arabic language speakers' region of origin country indicated that they came from various regions where Arabic dialects are spoken and thus, there may be differences that require modifications to the PACV to improve its internal consistency. Overall, these findings strengthened previous reports about the contextual validity and internal consistency of the PACV surveys in various settings.[10,28,30,70] As vaccine hesitancy is constantly changing within a population and subgroups, ongoing monitoring to explore trends in vaccine hesitancy is required to inform immunization programs and service delivery.

Study strengths and limitations

This study has notable strengths in that the PACV survey was made available in four languages and used two distribution channels to improve the response rate among former refugee parents. Additionally, the survey collected many factors and logistic regressions enabled adjustments for confounding factors influencing vaccine hesitancy. However, there were some limitations. There may be a limitation in reflecting participants' sociodemographic characteristics and context in terms of age, income, and duration of residence as a range was offered to facilitate participants' responses. As the study is a cross-sectional design, it could not establish a causal link between sociodemographic factors and vaccine hesitancy. The study involved a small nonrandom sample; therefore, caution should be taken when generalizing the findings. To support recruitment of refugees, who are often described as a "hard-to-reach" community, two modes of surveys were used (online and paper) which may have introduced sampling bias. As a result, the study sample may not be a proportional representation of the diverse refugee community in NZ.[34] Notably, former refugees of East African and Middle Eastern descent are likely overrepresented in the presented study as the surveys were available in Arabic, Somali and Oromo, in addition to English. Moreover, caregiver responses could have been influenced by a potential social desirability bias and recall-bias, additional bias may also be present due the variability of nonresponse to some of the PACV items. Importantly, the PACV behavioral domain (items 3 and 4) does not address the frequency and type of vaccines being delayed or refused. Therefore, these items might need to be modified so that they can capture information about how many times parents delayed or refused vaccines along with the reasons for delay or refusal, and if they delayed and/or refused all vaccines or selected ones.[70] Despite these limitations, this study provides valuable knowledge for future research on vaccine hesitancy among resettled refugees. Qualitative research that explores contextual and socio-cultural aspects not covered by the PACV survey that may contribute to vaccine hesitancy among resettled refugees is warranted.

Conclusion

The rate of vaccine hesitancy among former refugees in NZ was low, and there was a significant influence of educational level and primary source of vaccine information. The results underscore the importance of formal education and the role of health professionals in improving vaccine confidence among former refugees. To address vaccine hesitancy among resettled refugees, health and vaccine literacy that is tailored to their concerns about vaccine side-effects, safety and efficacy are required.

Disclosure statement

No potential conflict of interest was reported by the author(s)

ORCID

Nadia A. Charania 🆔 http://orcid.org/0000-0002-8265-5742

Authors' contributions

MSD: designed the study, collected, and analyzed the data, and drafted the manuscript.

NG and NC: participated in the design of the study, guided and reviewed data collection and analysis outputs, and edited and revised the manuscript.

All authors read and approved the final manuscript.

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