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A behavior change model to address caregiver hesitancy around COVID-19 vaccination in pediatrics



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ABSTRACT

Introduction: Many families express hesitancy around immunizing their children against COVID-19. We sought to better understand the perspectives of vaccine hesitant caregivers, and develop targeted recommendations for health care workers and policymakers to engage in more effective vaccine discussions.

Methods: We conducted semi-structured telephone interviews with 23 caregivers recruited from a pediatric infectious diseases clinic, including a subset of patients referred to discuss vaccine hesitancy. Thematic analysis of the interviews identified themes that were mapped using behavior change models to identify perceived barriers and facilitators towards COVID-19 immunization.

Results: Barriers and facilitators were mapped to the WHO (World Health Organization) 3C's (confidence, complacency, convenience) model of vaccine hesitancy as well as the COM-B (capability, opportunity, motivation) behavior change model. Barriers included mistrust in authorities, misperception of the risk of COVID-19 in children, and perceived health contraindications and negative previous vaccine experiences. Facilitators included positive relationships with healthcare workers, the promise of a "return to normal", and societal pressures to immunize.

Conclusions: Efforts to increase vaccine uptake in the pediatric population must target specific barriers and facilitators to immunization expressed by caregivers. To address these concerns, we suggest: 1. Educating hesitant caregivers by highlighting the long-term pandemic effects on children and the threat of COVID-19 to children's health, 2. Building on the trust caregivers have in healthcare workers by involving frontline workers in public health policy, and 3. Harnessing the power of peer pressure by mobilization of societal pressures and establishing COVID-19 vaccination as the norm in children.

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1. Introduction

The COVID-19 pandemic has emerged as one of the greatest public health threats in history, with over 556 million infections and 6.3 million deaths worldwide attributed to the SARS-CoV-2 virus as of July 2022 [1]. The emergence of the Omicron variant has become of particular concern in the pediatric population, which has seen the largest proportion of active new infections

Abbreviations: COVID-19, coronavirus 2019; HCWs, Health care workers; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; TDF, Theoretical Domains Framework; VHC, Vaccine Hesitancy Clinic; WHO, World Health Organization.

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and increasingly severe outcomes despite vaccine availability for younger children [2]. According to the World Health Organization (WHO), vaccine hesitancy, defined as a delay or refusal of vaccines despite their availability, was named one of the top ten threats to public health even before the first cases of COVID-19 [3]. Experts have long called for a widespread vaccine campaign as the only viable option to end the pandemic [4]. However, acceptance towards immunization remains a contentious issue, particularly as it pertains to children, with data from a recent nationwide Canadian survey indicating that nearly 1 in 4 parents do not plan to vaccinate their children [5]. Even as the highly infectious Omicron variant continues to spread and with evidence showing the vaccine is safe in children, overall uptake remains low, with less than 40% of eligible children in the 5–11 age group having received at least

one dose of the vaccine in the United States [6]. Addressing the concerns of vaccine hesitant caregivers is therefore critical to both personal protection, as well as reaching community protection thresholds needed to curtail the spread of infection [7].

Evidence demonstrates that behavior change interventions with a theoretical basis are more effective than those without, including for COVID-19 vaccine hesitancy [8]. The Theoretical Domains Framework (TDF) was developed to understand determinants of behavior to guide implementation strategies pertaining to healthcare [9]. The framework allows for identification of individual factors, such as beliefs and motivators, in addition to social and environmental influences which guide behavioral change, all of which are relevant to vaccine hesitancy. This framework has been used in vaccine-based research to characterize behaviors and implement behavioral change [10]. Similarly, the COM-B (capability, opportunity, motivation-behavior) model outlines that a specific behavior will occur when the capability and opportunity exist, and there is some sort of motivation to perform that behavior. This model has been applied to understanding behavior change pertaining to COVID-19, including wearing of masks and physical distancing [11]. Finally, the WHO Strategic Advisory Group of Experts (SAGE) on Immunization describes hesitancy as related to three main factors, the “3C’s of vaccine hesitancy”: *confidence, complacency, and convenience* [12]. *Confidence* relates to perceived trust in the efficacy of vaccination and the healthcare system and workers who deliver the vaccine; *complacency* relates to beliefs that vaccination is not necessary because of perceived low risk of contracting COVID-19; *convenience* relates to factors which affect ability to access vaccination. Utilizing the TDF framework and the 3C’s and COM-B models, we sought to develop recommendations rooted in behavioral change to guide and empower health care workers (HCWs) discussions with COVID-19 vaccine-hesitant caregivers for children’s vaccination.

2. Methods

2.1. Participants

Study participants (n = 23, of the 28 approached) were caregivers recruited from an infectious diseases clinic at a pediatric tertiary care center. This clinic includes a Vaccine Hesitancy Clinic (VHC), which accepts referrals from a variety of physicians, including both general practitioners and pediatricians, to address any caregiver concerns regarding vaccines. The VHC is run by pediatric infectious disease subspecialists with special interest in vaccinology. Participants were subdivided into three categories: 1. Those seen at the infectious diseases clinic for a reason other than vaccine hesitancy, 2. Those seen at the VHC who accepted vaccinations within 6 months for their child after attending their clinic appointment, and 3. Those seen at the VHC who did not accept vaccines within 6 months after the appointment. We enrolled the first group of participants prospectively as they attended the clinic appointment with their child, while the latter two groups were enrolled retrospectively using records of patients who had previously consented to future contact for research studies. A random number generator was used by clinic staff to contact prospective participants via telephone and obtain consent to participate.

2.2. Materials

A semi-structured telephone interview guide was developed using the TDF, assessing fourteen behavioral constructs to identify specific determinants that guide behavior change: knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, reinforcement, intentions, goals, attention and decision processes, environmental

context and resources, social influences, emotion, and behavioral regulation [8]. Interviews were conducted between November 2020 to January 2021. We asked participants a series of open-ended questions about their perceptions, attitudes and motivation to vaccinate their children against COVID-19. Two research assistants conducted the interviews, which each lasted approximately thirty minutes. The interviews were audio-recorded and transcribed by a third party; the study authors reviewed the de-identified transcripts to ensure accuracy.

2.3. Analysis

Two researchers coded the transcripts with NVivo software [13]. Nodes were initially coded using a deductive approach according to the 3C’s model of vaccine hesitancy. Within these nodes, inductively coded sub-themes arose using the COM-B model as a framework to identify both facilitators and barriers towards immunization. Sub-themes were developed based on both the frequency (i.e. multiple respondents sharing similar sentiments) and impact (i.e. facilitators towards immunization from participants who attended the VHC and subsequently accepted vaccinations for their child) of data. To ensure consistency, we performed coding comparison queries among a randomly selected subset of nodes to ensure greater than 95 % agreement between coders. Any items with lower than 95 % agreement were flagged for discussion with two other researchers. We reached thematic saturation.

3. Results

In total, twenty-three participants completed the telephone interview. Seventeen participants attended the VHC and of those, ten had proceeded to vaccinate their children post appointment. We recruited the remaining six participants from the general Infectious Diseases Clinic. Table 1 shows the demographic data of our participants. In summary, 91 % (n = 21) of participants identified as female, and the majority were between 30 and 44 years of age (65 %, n = 15). 70 % of participants identified as White/Caucasian (n = 16); the remainder identified as Black (9 %, n = 2), South Asian (4 %, n = 1), and East Asian (4 %, n = 1). 52 % of participants (n = 12) reported having completed their undergraduate degree.

We collated the nodes and subthemes to generate barriers and facilitators to COVID-19 vaccine uptake in caregivers of children as

Table 1
Demographic information from interview participants.

	Number of Participants	Percentage of Participants
Gender		
Male	2	9 %
Female	21	91 %
Age (years)		
18–29	1	4 %
30–44	15	65 %
45–64	6	26 %
Other/prefer not to say	1	4 %
Level of Education		
High school graduate or less	2	9 %
College/technical school	6	26 %
Undergraduate degree	12	52 %
Post-graduate degree	2	9 %
Other/prefer not to say	1	4 %
Race		
White/Caucasian	16	70 %
Black/African-American	2	9 %
East Asian	1	4 %
South Asian	1	4 %
Other/prefer not to say	3	13 %

shown in Tables 2 and 3, alongside relevant quotes from the transcribed interviews. In summary, barriers to immunization related to *confidence* in vaccine safety included inconsistent messaging and frequently changing guidelines around public health measures, as well as general mistrust in governments and the pharmaceutical industry; some participants even went as far as to describe the pandemic as a hoax. Previous negative experiences with the healthcare system and/or with vaccines were also barriers. Major barriers related to *complacency* included participants believing they were protected from COVID-19 by following public health recommendations around physical distancing and isolation, and the perception that this disease is not a serious threat to children. Several of these participants affirmed that they are generally “pro-vaccine”, but in weighing the potential risk versus benefit of the vaccine, their concerns around vaccine safety drove their current desire to delay vaccination in their children. Barriers to *convenience* included perceived vaccine contraindications due to health comorbidities or previous experiences with vaccination.

Conversely, facilitators to immunization highlighted with respect to *confidence* included direct recommendations from

Table 2
Barriers to COVID-19 immunization, with selected quotes from participants.

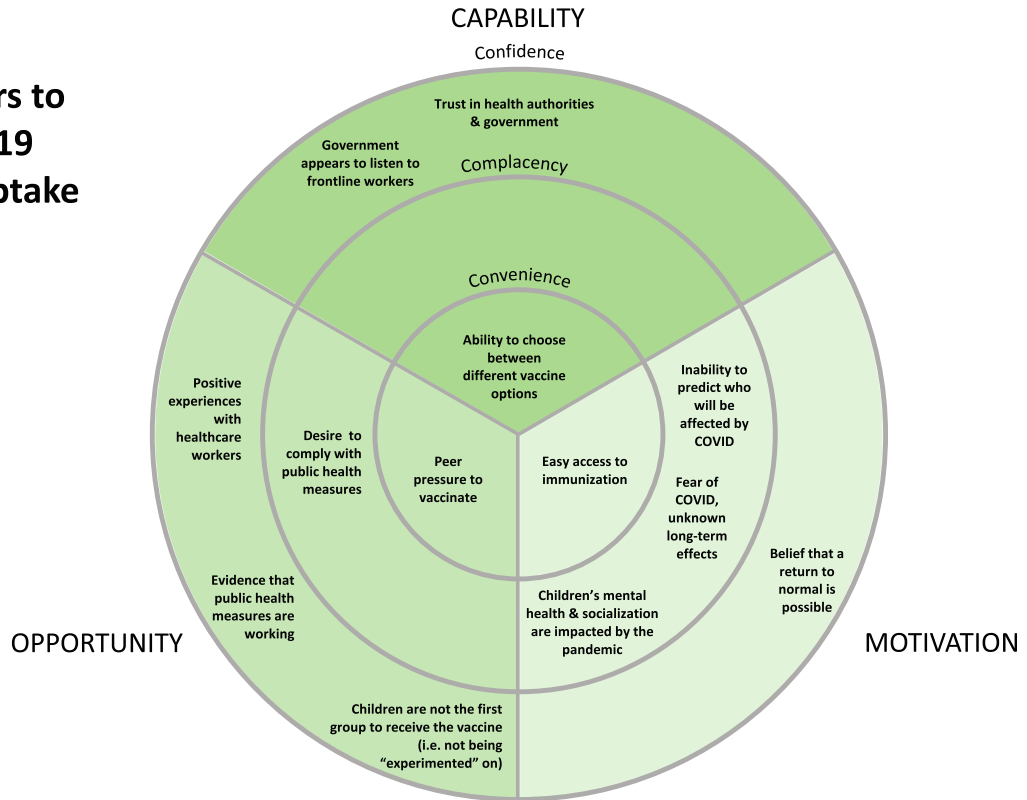
	Barriers to Immunization	Selected Quotes
Capability	<ul style="list-style-type: none"> -Changing public health recommendations -Historic lack of trust in health agencies and governments -Cultural trauma -Mistrust in pharmaceutical industry -Skepticism around vaccine development and safety 	<p>“There’s so much confusion and inconsistencies with the messaging that we’re getting. . . I just don’t have a lot of faith in politics right now, in our leaders. I think we’re doing so many things backwards or inconsistently that it’s two steps forward, one step back and if we were to just focus on getting this under control, we would be better off in the long run.”</p> <p>“I find it very odd that they have a vaccine for coronavirus when we haven’t had one in all the years of mankind. And then all of a sudden this COVID-19 comes out and now they have a vaccination. We never had one before. . . They just worked on it as soon as these G7 countries all wanted to do a reset. It’s just too coincidental.”</p>
Opportunity	<ul style="list-style-type: none"> -Negative interactions with health care workers -Negative experience with previous vaccinations -Perception that other groups are higher priority in terms of receiving the vaccine than children -Individualism, i.e. feeling safe in isolation, able to stay home from work and school 	<p>“Nobody really knows for sure what the long-term effects could be. Like my son, and the reason I went to the hesitancy clinic in the first place was because my son had an MMR vaccine and within the week he was diagnosed with leukemia.”</p> <p>“Someone like myself and my family, I think kind of where we are is at bottom of the pack, back of the line kind of thing because we don’t have a lot of exposure really. We don’t have to go and see people every day and work in hospitals and such like that.”</p>
Motivation	<ul style="list-style-type: none"> -Personal safety and wellbeing more important than social/economic gain -Perception that children are at low risk of COVID 	<p>“I feel the chances of us getting it is pretty slim. . . I perceive it as pretty low. I mean, you look at 500 deaths over 4 million people, and most of those deaths, the majority are people that are seniors 70 plus.”</p>

healthcare workers, and positive relationships and past interactions with them. The overwhelming majority of participants cited their physicians as a trustworthy source of information about COVID-19. A theme that specifically emerged from the group that had attended the VHC and immunized their children was that direct input from frontline health workers to policy makers helped combat their own mistrust in governments. *Complacency*-related facilitators included concerns about the impact of the SaRS-CoV-2 virus on children’s mental wellbeing and socialization due to isolation requirements, and the idea of a “return to normal” being a powerful motivator in the decision to vaccinate. The paucity of information around long-term effects of COVID-19 was also a recurring facilitator. Finally, facilitators related to *convenience* included peer pressure to choose immunization, and the fear of being ostracized in both professional (i.e. work) and social (i.e. with family and friend groups) settings if unvaccinated.

Table 3
Facilitators to COVID-19 immunization, with selected quotes from participants.

	Facilitators to Immunization	Selected Quotes
Capability	<ul style="list-style-type: none"> -Trust in health authorities & government -Government appears to listen to frontline workers -Ability to choose between different vaccine options -Vaccination is more effective than natural immunity 	<p>“I don’t think COVID-19 is going away anytime soon. I think just like anything else that we were taking vaccination for, I think that it’s important to safeguard yourself against those things. Even though maybe they’re not super rampant like, I don’t know, measles and mumps, we don’t see that every day, but we still get vaccinated for it because it’s the right thing to do to keep ourselves safe and to keep others safe.”</p>
Opportunity	<ul style="list-style-type: none"> -Positive interactions with health care workers -Trust that public health measures are working -Children are not the first group to receive the vaccine (i.e. not being “experimented” on) -Desire to comply with public health measures -Peer pressure towards getting vaccinated 	<p>“I don’t want to be ostracized. It’s a pretty challenging thing to not [get immunized] because there are just such strongly held opinions on both sides and the people who are very, very pro-vaccine, no matter what, are very vocal. . . It just, it really sucks being someone who has at this point made different decisions from the majority. And I’m surprised by how much that’s making me. . . almost want to [say] yes.”</p> <p>“Just because you don’t believe it doesn’t mean it doesn’t exist. We all have to work together to make this end. I want to be able to see my family. . . So it’s one thing to believe, but we should follow by the rules. We’ve got to pay our taxes, even if you don’t believe it, right?”</p>
Motivation	<ul style="list-style-type: none"> -Fear of COVID and long-term effects -Idea of a return to normal, allowing kids to socialize 	<p>“If you look at something like Lyme disease, where once you get it, you essentially are disabled for life, depending on how severe it is and what happens. People can struggle with that for an entire lifetime. I think that it sounds like COVID is presenting with all sorts of weird follow-up things that nobody can definitively link. They’re not sure what being a COVID survivor is going to look like in five years. I think that that going to be a huge reckoning for people down the line.”</p>

Facilitators to COVID-19 Vaccine Uptake



Barriers to COVID-19 Vaccine Uptake

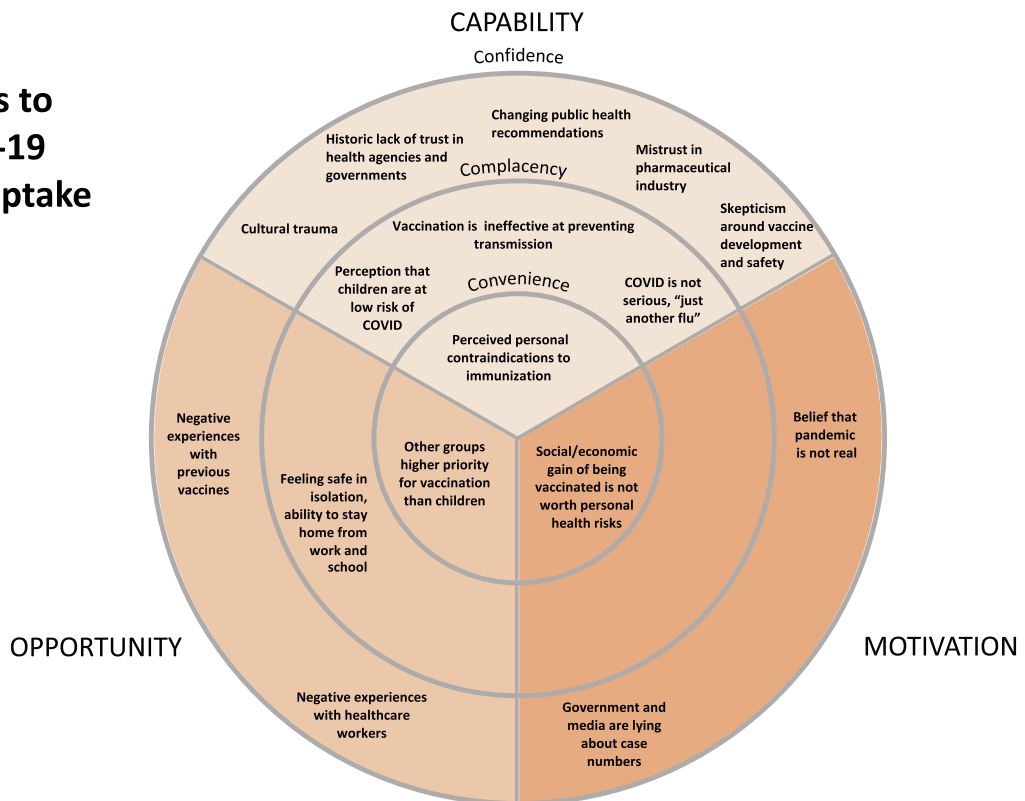


Fig. 1. COM-B behavior change model of COVID-19 vaccine hesitancy, with barriers and facilitators to vaccination mapped to behavioral constructs and vaccine hesitancy determinants.

4. Discussion

We used the qualitative research method of thematic analysis using the TDF to determine facilitators and barriers to COVID-19 vaccine uptake among caregivers for their children. These barriers and facilitators can generate behavioral change-based interventions to promote pediatric COVID-19 vaccine uptake, both in one-on-one interactions between HCWs and vaccine hesitant patients, as well as through general messaging at the population level. To help display this approach, we used the COM-B model of behavioral change and the well-established WHO 3C's of vaccine hesitancy. Fig. 1 displays the identified barriers and facilitators towards COVID-19 immunization mapped to both the behavioral constructs of the COM-B model (capability, opportunity, motivation-behavior) as well as to the vaccine hesitancy determinants of the 3C's model (confidence, complacency, and convenience).

Drawing on the presented model in Fig. 1 and published literature on vaccine hesitancy, when counseling individual caregivers about COVID-19 immunization, we suggest that HCWs explore previous vaccine history regarding cultural and childhood trauma and how this impacts decision to vaccinate, acknowledge previous negative and positive interactions with healthcare workers, and specifically elicit and address perceived personal contraindications to immunization [14,15]. As shown in some survey studies, we found that individual messaging should focus on the personal health benefits of the vaccine, the detrimental effects of the pandemic on mental health and socialization of children, and highlight how other parents have chosen to vaccinate their children, for example, harnessing the facilitators identified as peer pressure to vaccinate [16]. If available or applicable, offering parents a convenient and easily accessible choice for vaccination may also help increase vaccine uptake. For example, parents support school-based vaccination programs and drop-in versus appointment access [16].

For public messaging, we suggest that the focus be on vaccination as a desirable behaviour, outlining its contribution towards the new “return to normal”, providing evidence that public health measures are effective in limiting severity of COVID-19, as well as highlighting groups and jurisdictions that have been successfully vaccinated already [17]. From our data, to combat complacency, we suggest messaging COVID-19 in children as a vaccine preventable disease with a significant toll in the pediatric population, and that the longer-term effects of COVID-19 in children are increasing; the burden of long COVID is being better understood and emerging as a concern in pediatric populations as well [18]. Furthermore, HCWs cannot predict which children will develop mild versus severe responses to COVID-19 infection, even individuals who have complied as much as possible with public health measures are infected, and very careful isolation does not result in full protection from infection. As with vaccine hesitancy related to other vaccines, one needs to address the peer pressure facilitator for vaccine uptake. We suggest that to facilitate this, parent groups who have vaccinated their children should be engaged as they are important ambassadors for pediatric vaccination, helping to position vaccine acceptance as a norm, rather than an optional course for parents [19].

Looking at the types of interventions that might be suited to our COM-B model for pediatric COVID-19 vaccines, we recommend that: 1. Capability gaps be addressed via educational initiatives (highlighting vaccine safety, prioritizing children's health in the pandemic, showing how HCWs contribute to public health recommendations), 2. Opportunity gaps be addressed by increased vaccine access, adopting measures other jurisdictions or specific populations have used for better uptake, and highlighting positive work of healthcare workers in the pandemic, 3. Motivation gaps be

addressed via mandates when applicable, communicating a longer term view of children's health and putting the COVID-19 effect on children in the context of changing public health restrictions, and focusing messaging on personal protection (rather than communicating about children's vaccination as a collective responsibility).

The strength of our study is that we were able to draw upon pre-identified vaccine hesitant caregivers to explore their perspectives around pediatric COVID-19 immunization and map their concerns to a validated behavior change model. Understanding vaccine attitudes among these motivated parents allowed us to generate pragmatic facilitators and barriers to vaccine uptake. Limitations of the study include the ability to generalize these findings to other centers, owing to the qualitative nature of the data. Most of our study sample identified as female (91 % of participants); however, it is known that mothers are more likely to accompany their child to medical appointments and therefore make health decisions for their families [20]. In addition, most of our sample (70 %) identified as White. Although this percentage is similar to the demographics of the catchment area our institution services, given the known impacts of race and ethnicity on medical interventions including decision to vaccinate, future research may wish to further explore the perspectives of ethnic minorities with respect to COVID-19 immunization [21].

5. Conclusion

While existing data suggests that many parents will vaccinate their children against COVID-19, hesitancy requires attention to reach high levels of protection. The evolving pandemic provides a unique opportunity to understand determinants of vaccination intention in the vaccine hesitant population. In mapping these determinants to existing behavior change and vaccine hesitancy models, we have identified barriers and facilitators to vaccination that may be amenable to targeted intervention efforts. Specifically, interventions that use public education can address issues around vaccine capability, mobilizing social pressures and societal norms can target issues around opportunity, and public health and government mandates can address vaccine motivation. We are hopeful that our results will help tailor implementation strategies in both the current vaccine rollout and as governments and health agencies tackle pediatric vaccination efforts. Future research is needed to assess the generalizability of these barriers and facilitators to other settings, as well as the efficacy of these recommendations in increasing COVID-19 vaccine uptake.

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Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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