Title: Childhood and adolescent immunisation intentions post-COVID-19 in Lusaka, Zambia

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Abstract

Background: Since the COVID-19 pandemic, parental delays and refusals of well-established, safe, and effective childhood vaccinations have contributed to the resurgence of infectious diseases. This raises concerns that COVID-19 vaccine hesitancy may also extend to novel vaccines for children when introduced in the future. This study examined caregivers', who included healthcare workers (HCWs), perceptions of novel vaccinations for children ages 0-17 years old and intentions to vaccinate children and adolescents ages 12-17 years against COVID-19.

Methods: We conducted a secondary data analysis of a larger cross-sectional survey administered to parents/caregivers of children ages 0-17 years in Lusaka, Zambia, between 13 November and 15 December 2023. Vaccination intention for COVID-19 was specifically focused on caregivers of adolescents ages 12-17 years, following COVID-19 vaccination guidelines during the study. Descriptive statistics were used to explore demographic characteristics, vaccination history, and caregivers' COVID-19 vaccination status, along with their children's routine childhood vaccine histories and perceptions of COVID-19 and novel vaccinations.

Results: Among 277 caregivers (66.8% women, median age: 35 years), 93.1% reported that their child had received all recommended routine childhood vaccinations. COVID-19 vaccine uptake was higher among HCWs (68.2% with ≥2 doses) than among community members (40.8%) and having ≥2 doses was associated with higher COVID-19 vaccine uptake among their adolescents ages 12-17 years. 58.0% of caregivers indicated that their 12-17 years old adolescents had received at least one COVID-19 vaccine dose. Overall intention to further vaccinate children against COVID-19, especially among those already unvaccinated, remained low, with 24.7% of caregivers reporting no intent to vaccinate their children. Protection from hospitalization and death from malaria, TB, HIV, pneumonia, influenza, and diarrheal diseases were the most cited reason (79.1%) for intention to vaccinate children with novel vaccines for these diseases. The most prominent reasons for reluctance towards future vaccines were the fear of potential side effects (45.5%) and insufficient knowledge about vaccination benefits and risks (31.8%). Caregivers most trusted the Ministry of Health (86.6%) and healthcare professionals (66.8%) as sources of vaccine information.

Conclusions: While routine childhood vaccine uptake remained high, acceptance of COVID-19 and future novel vaccines for children was lower and was influenced by caregivers' own vaccination status. Targeted and transparent communication through trusted sources such as the Ministry of Health and healthcare professionals may be critical for addressing safety concerns and strengthening confidence in novel childhood vaccines.

Introduction

Childhood vaccinations are one of history's greatest public health wins, saving millions of lives every year. However, these gains are fragile. When a lack of confidence in vaccines grows, as was observed during the COVID-19 pandemic, immunization coverage rates drop, allowing vaccine-preventable diseases like measles and polio to return (1). In addition to disruptions in regular health services and diverted resources during the pandemic (2), various reasons such as fear of COVID-19 infection at facilities where vaccines are administered contributed to parents' lack of confidence in the vaccine toward routine childhood vaccines (3). This lack of confidence persisted post-COVID-19, leading to a drop in routine childhood vaccine uptake and a rise in numbers of unvaccinated children worldwide (2). In 2024, an estimated 18 million infants compared to 13 million in 2023, did not receive the first dose of diphtheria, tetanus and pertussis (DPT)-containing vaccine (zero-dose), an important indicator for a child's access to health system (4), with a 7% increase in zero-dose children in Zambia from 2019 to 2024(5). Additionally, the number of infants not completing routine vaccinations, defined as not receiving the third DTP dose by their first birthday, rose from 6 million to 25 million (6) despite ready availability through the Expanded Programme on Immunization (EPI) (7, 8). Parental vaccine hesitancy persisted beyond infancy with a study across 12 sub-Saharan African countries revealing that 21.2% parents of children aged 19 months to 6 years were hesitant towards routine childhood immunization (9). In Zambia, disruptions during the COVID-19 pandemic led to an increase in measles cases and deaths among young children (median age of 3 years) and a 2% increase in monthly measles mortality in the post-pandemic period (3). Thus, lack of confidence in COVID-19 vaccines threaten progress in infectious disease control and undermines advancements in widespread access to vaccines (10).

While childhood vaccine coverage in Zambia is historically high compared to Western countries(11), there is concern that lack of confidence in the novel COVID-19 vaccine may extend to other new and routine childhood immunizations. While COVID-19 vaccine programs initially prioritised adults, many countries expanded access to include children aged 12 years and older. However, some countries reported vaccine hesitancy among adults for themselves and for their children including due to fear of side effects, misleading information, and uncertainty of the effectiveness of the vaccine for their children (12). Suboptimal uptake has also been observed for other vaccines targeting adolescents. For example, nearly half (46.1%) of the 4,830 caregivers of girls aged 9–17 years enrolled in a cross-sectional study in Nigeria, reported that the girls under their care had not received the human papillomavirus (HPV) vaccine (13). These findings suggest that challenges associated with acceptance of newly introduced vaccines may extend beyond COVID-19 and affect future vaccination programmes targeting older children and adolescents.

Emerging evidence also suggests considerable lack of confidence among adolescents themselves. A multi-country study among 2662 adolescents aged 10-19 years in rural and urban Ghana, Nigeria, Ethiopia and Tanzania

reported high levels of vaccine hesitancy, with 39.4% reporting no intention and 9.6% uncertain about getting vaccinated due to concerns regarding necessity, effectiveness and safety. Among those willing to be vaccinated, motivations included protecting themselves or their families followed by parental vaccine (13). Similarly, a qualitative study in South Africa and Nigeria among 15-24 years old adolescents found that fear, distrust of government, conspiracy theories and unhappiness towards perceived coercion contributed to negative attitudes, while protecting family members, social responsibility for herd immunity, and resuming normal activities such as travel, socialising and being unmasked motivated vaccine acceptance (14).

On 5th of October 2022 the Ministry of Health in Zambia announced the launch of a COVID-19 vaccination campaign targeting adolescents 12 to 17. However, evidence on determinants of vaccine hesitancy among caregivers of adolescents in Zambia remains scarce as apart from HPV vaccines there are no other vaccines targeted at this age group, and the influence of parental COVID-19 vaccination status on children's vaccination is understudied.

To address these gaps, we examined caregivers' perceptions of novel vaccinations for children aged 0 to 17 years and intentions to vaccinate their adolescents aged 12 to 17 years against COVID-19 following COVID-19 vaccination guidelines at the time of the study. This sub-study was nested in a larger study examining the association of COVID-19 vaccination uptake and vaccine intention for newly introduced adult vaccines among community members and HCWs in Lusaka, Zambia. We included community perspectives as public health efforts targeting childhood immunization must account for caregivers' underlying perceptions and leverage trusted information sources to deliver effective vaccine messaging (15). We also included healthcare workers (HCWs) because they represent a critical interface between caregivers and vaccine introduction, and their attitudes can strongly influence parental decisions regarding childhood vaccinations (16, 17). Examining HCWs' perspectives on childhood vaccination, including their willingness to vaccinate their own children, may provide important insight into both the drivers of vaccine acceptance and potential barriers to uptake.

Methods

Study Design

We conducted this secondary analysis as part of a larger cross-sectional survey in Lusaka, Zambia (18). For this analysis we sought to assess caregiver attitudes and preferences about childhood vaccination among community members and HCWs. Community members were recruited from randomly selected households in four high-density, low-income urban communities with relatively low COVID-19 vaccination coverage and HCWs were recruited from ten healthcare facilities chosen for diversity in size and geographic location. All participants were enrolled between 13 November and 15 December 2023, which was after COVID-19 waves and disruptions in Zambia. COVID-19 vaccinations were officially launched in April 2021for adults (19) and December 2021 for

children 12 to 17 years, followed by two campaigns in May and October 2022 to encourage parents to have their children vaccinated (20) and reach the 70% vaccination goal for eligible populations (21), respectively.

Study Population and Recruitment Strategy

Participants were eligible if they were aged 18 years or older, resided in Lusaka Province, and HCWs were eligible if they provided direct clinical or community-based healthcare services. Parents or primary caregivers, henceforth referred to as caregivers, were defined as those reporting being responsible for caregiving for any children under 18 years old at the time of screening.

HCWS were purposively selected from 10 healthcare facilities including one university tertiary hospital, five first-level hospitals, three Urban Health Centres, and one Rural Health Centre to represent a diversity of sizes and geographic locations; additional detail on the sampling approach has been previously described (18, 22). Recruitment occurred across five healthcare facility departments: Mother and Child Health (MCH), Outpatient (OPD), TB, Adolescent, and ART clinics. More details on the recruitment strategies have been previously reported (23).

Non-HCW community members participants were recruited from 10 administrative zones subdivided into 10 neighbourhoods of approximately 100 households. We randomly selected one zone per community and applied systematic household sampling. Within neighbourhoods, the initial household was selected using the "spin-the-bottle" technique, followed by every 5th household to the right for a total of 10 households per neighbourhood and 100 households per zone. The first eligible and consenting household member was recruited. To ensure the communities were well represented, extra data collections efforts were carried out on weekends specifically to invite and recruit people, mostly men, who tend to work regular hours during the week.

Ethical Considerations

The study protocol was approved by the National Health Research Ethics Board (NHRA 000002/17/08/2023) and the Institutional Review Board at Washington University in St. Louis (IRB#: 202308190). All participants provided written informed consent in their preferred language.

Data Collection and Management

Trained Research Assistants (RAs) collected data electronically on tablets in the participant's preferred language (English, Nyanja, or Bemba) using Sawtooth Software Lighthouse Studio Offline Surveys. The survey included sociodemographic information, child immunization history, knowledge, attitudes, and concerns about both current and novel adult and childhood vaccines, sources of vaccine information and trust in information channels, and intentions to vaccinate children with currently available and future vaccines. Participants received 100

Zambian Kwacha (ZMW; ~USD $4 at the time of the study) as reimbursement for their time. We implemented daily data quality checks to ensure accuracy with the research team addressing any discrepancies in the collected data compared to the survey logs and completeness of survey responses as previously reported (22).

Analysis

We summarized demographic characteristics, vaccination status, among caregivers using descriptive statistics. We examined factors associated with caregiver intention to vaccinate children for COVID-19 and potential new vaccines, stratified by participant type (community, HCW) and the number of COVID-19 vaccine doses the caregiver had received (0, 1, or ≥2 doses). We compared community and HCW attitudes to identify key differences between groups and if so, where interventions should focus (e.g., community education or HCW training and support). This comparison matters particularly for HCWs because they are a primary trusted source, and their own beliefs, including willingness to vaccinate their children, shape credibility and strength of health recommendations. Continuous variables were compared using independent sample t-tests, and categorical variables were compared using chi-square tests. Beyond attitudes, we also compared actual COVID-19 vaccine uptake to see whether parents' own vaccination behaviour and attitudes predict whether their children get vaccinated. We also explored reasons reported by caregivers for and against vaccination for their children. All analyses were conducted in Stata (16.1, StataCorp LLC, College Station, TX).

Results

A total of 277 participants with children aged <18 years (211 community members and 66 HCWs) were included in the analysis, with women comprising 66.8% of this caregiver population and a median age of 35 years (IQR 29-44 years) (Table 1). Differences between community members and HCWs were observed in education and employment with community members more likely to have no education (20.9%) or some secondary schooling (35.1%), while HCWs predominately had post-secondary education (75.8%). Community members were more often unemployed (25.6%) or self-employed (32.7%) compared to HCWs (0.0% and 0.0%, respectively), whereas HCWs were mainly formal employees (65.2%) or volunteers (34.8%). Most participants were married or cohabiting (67.5%). Approximately 12.0% reported living with HIV in both groups (community members and HCWs).

Most participants (56.7%) had one or two children, with 34.3% with three or four children, and 8.3% with five or more children. Among participants with children, 16.6% had at least one child aged <1 year, 47.3% had children aged 1–4 years, 62.8% had children aged 5–11 years, and 54.2% had children aged 12–17 years. Patterns were broadly similar across groups, except HCWs were less likely than community members to have young children aged 1–4 years (36.4% compared to 50.7%, respectively).

Table 1. Participants characteristics (n=277)

	Total n=277 n (%)	Community n=211 n (%)	HCW n=66 n (%)	p-value
Gender				0.98
Men	92 (33.2)	70 (33.2)	22 (33.3)	
Women	185 (66.8)	141 (66.8)	44 (66.7)	
Age, median years (IQR)	35 (29-44)	35 (28-45)	35.5 (29-43)	0.95
Age				0.35
18-24 years	22 (7.9)	19 (9.0)	3 (4.5)	
25-29 years	56 (20.2)	42 (19.9)	14 (21.2)	
30-34 years	54 (19.5)	39 (18.5)	15 (22.7)	
35-44 years	76 (27.4)	55 (26.1)	21 (31.8)	
45-54 years	39 (14.1)	29 (13.7)	10 (15.2)	
55+ years	30 (10.8)	27 (12.8)	3 (4.5)	
Education				<0.001
Less than secondary school	48 (17.3)	44 (20.9)	4 (6.1)	
Some secondary school	74 (26.7)	74 (35.1)	0 (0.0)	
Completed secondary school	77 (27.8)	65 (30.8)	12 (18.2)	
Post-secondary education	77 (27.8)	27 (12.8)	50 (75.8)	
Prefer not to answer	1 (0.4)	1 (0.5)	0 (0.0)	
Employment				<0.001
Unemployed	54 (19.5)	54 (25.6)	0 (0.0)	
Housewife/Carer	29 (10.5)	29 (13.7)	0 (0.0)	
Casual worker/Piece work	12 (4.3)	12 (5.7)	0 (0.0)	
Self-employed/Business	69 (24.9)	69 (32.7)	0 (0.0)	
Formal employee	75 (27.1)	32 (15.2)	43 (65.2)	
Student	3 (1.1)	3 (1.4)	0 (0.0)	
Retired	9 (3.2)	9 (4.3)	0 (0.0)	
Volunteer	25 (9.0)	2 (0.9)	23 (34.8)	
Other	1 (0.4)	1 (0.5)	0 (0.0)	
Marital Status				0.090
Single	49 (17.7)	33 (15.6)	16 (24.2)	
Stable relationship, not married	12 (4.3)	8 (3.8)	4 (6.1)	
Co-cohabiting/Married	187 (67.5)	142 (67.3)	45 (68.2)	
Divorced/Separated	15 (5.4)	14 (6.6)	1 (1.5)	
Widowed	13 (4.7)	13 (6.2)	0 (0.0)	
Prefer not to answer	1 (0.4)	1 (0.5)	0 (0.0)	
HIV status				0.83
PLHIV	33 (11.9)	25 (11.8)	8 (12.1)	
HIV negative	204 (73.6)	154 (73.0)	50 (75.8)	
HIV status unknown	40 (14.4)	32 (15.2)	8 (12.1)	
Number of children				0.14
1-2 children	157 (56.7)	115 (54.5)	42 (63.6)	
3-4 children	95 (34.3)	79 (37.4)	16 (24.2)	
≥5 children	23 (8.3)	15 (7.1)	8 (12.1)	
Missing	2 (0.7)	2 (0.9)	0 (0.0)	
Age of children*				
<1 year	46 (16.6)	38 (18.0)	8 (12.1)	0.26
1-4 years	131 (47.3)	107 (50.7)	24 (36.4)	0.042
5-11 years	174 (62.8)	130 (62.6)	44 (66.7)	0.46
12-17 years	150 (54.2)	112 (53.1)	38 (57.6)	0.52
Number of COVID vaccine doses received				<0.001
≥2	131 (47.3)	86 (40.8)	45 (68.2)	
1	67 (24.2)	49 (23.2)	18 (27.3)	
0	79 (28.5)	76 (36.0)	3 (4.5)	

*Children age groups were not mutually exclusive, and caregivers could select each age category applicable to their children;
HCW, healthcare worker

General and EPI vaccination among children aged 0 to 17 years

Generally, caregivers indicated that vaccines were very important for their child's health (93.1%), independent of their own vaccination status, with only 2.9% believing that vaccines were not important at all for their child's health (Table S1). While there were differences in COVID-19 vaccination status for children by caregivers' COVID-19 vaccination status, 93.1% of caregivers reported giving their children all recommended EPI vaccines, with no differences across caregivers' COVID-19 vaccine history. Overall, 6.1% did not have their child receive a recommended EPI vaccine.

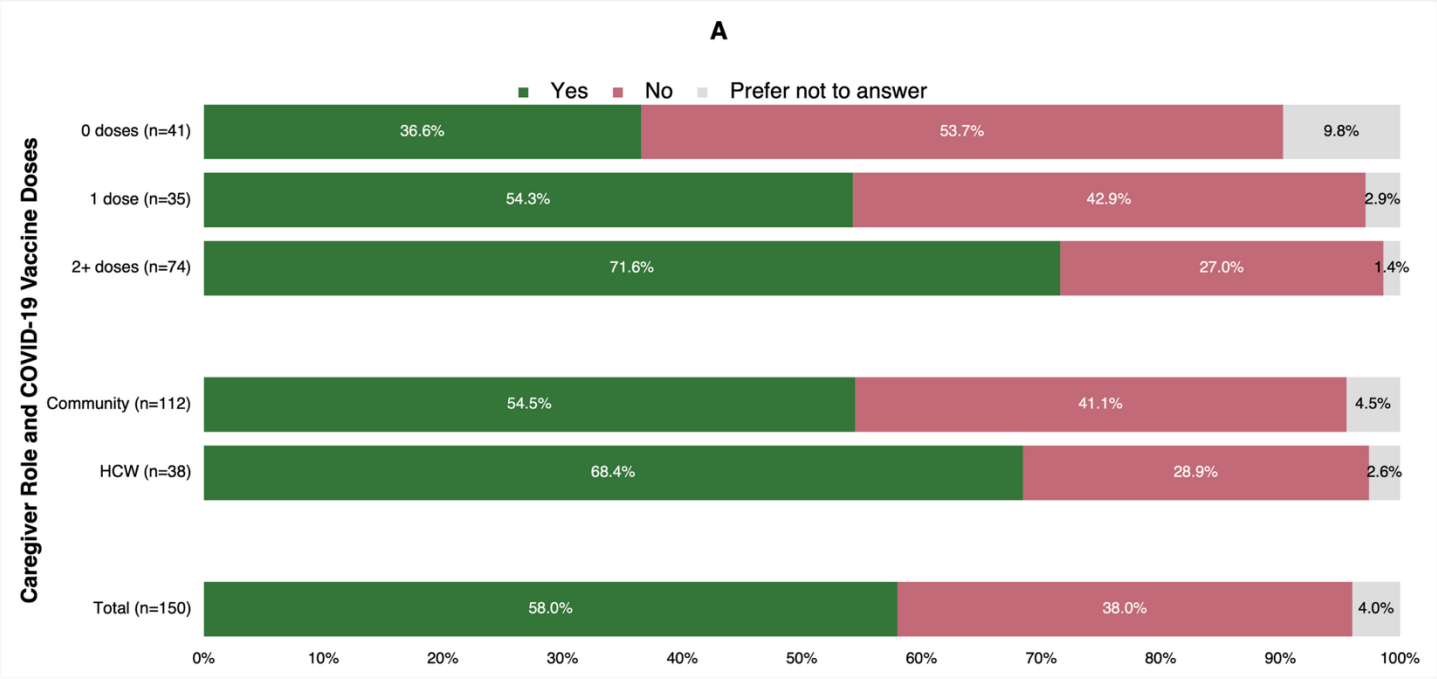
COVID-19 vaccination among caregivers

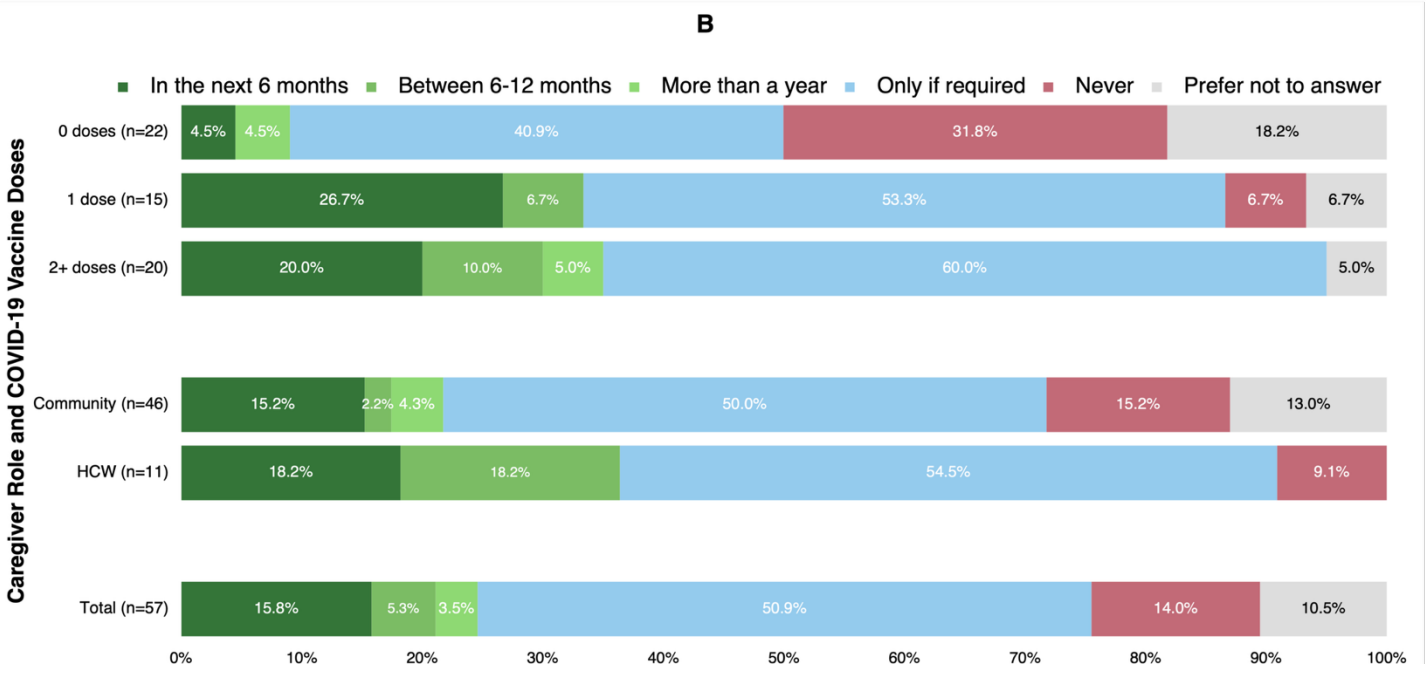
Regarding COVID-19 vaccination, 68.2% of HCWs received two or more doses compared to 40.8% of community members, while 36.0% of community members remained unvaccinated for COVID-19 compared to only 4.5% of HCWs (Supplementary Table 1). Timing of caregivers' first COVID-19 vaccine dose varied, with 37.9% vaccinated within 6 months of availability, 28.3% between 6–12 months, and 17.7% after 12 months. Caregivers with ≥2 doses (N=131; 47.3%) were more likely to vaccinate earlier than those with only 1 dose (42.7% vs. 28.4%, p=0.016). Vaccines were considered "very important" for children's health by 93.1% overall, regardless of caregiver COVID-19 vaccination or healthcare worker status. Only 6.1% reported not vaccinating their child (zero-dose DPT) with a WHO recommended childhood vaccine (i.e., diphtheria, tetanus, pertussis, measles, polio, TB), with no differences across caregiver vaccination COVID-19 status or role.

COVID-19 vaccination among adolescents aged 12 to 17

Among caregivers with adolescents aged 12 to 17 years (n=150), 58.0% indicated their child had received at least one COVID-19 vaccine dose and 38.0% reported their child had not received any COVID-19 vaccine doses. COVID-19 vaccine uptake was higher among children of caregivers with ≥2 COVID-19 doses (71.6%) compared with children of unvaccinated caregivers (36.6%, p=0.003), with no differences across HCW and community members (p=0.32) (Figure 1A, Table S1). Among all caregivers of adolescents, 24.7% did not intend to vaccinate their children for COVID-19, with 19.3% indicating they would vaccinate their children if required and 5.3% would never vaccinate their children. Among caregivers whose children were unvaccinated, only 24.6% intended to have their child vaccinated (15.8% in the next 6 months) (Figure 1B, Table S1).

Figure 1. COVID-19 vaccination among adolescents aged 12-17 years. A) Any received COVID-19 doses among children 12-17 (n=150) and B) intention to vaccinate children 12-17 for COVID-19 among those not vaccinated (n=57), by caregiver COVID-19 vaccination and role





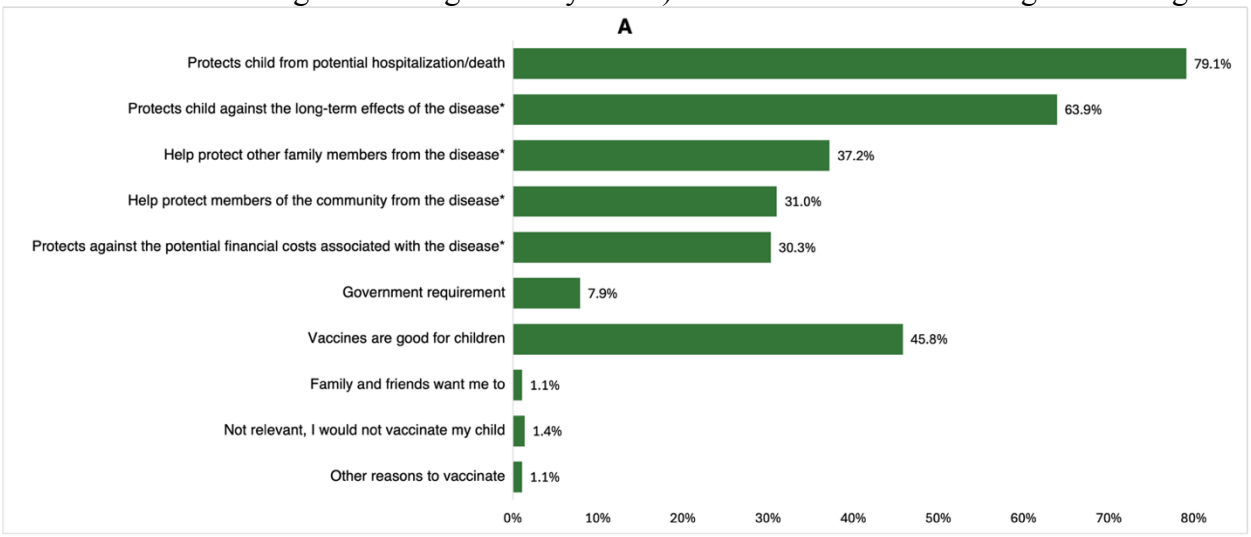
Reasons for vaccinating among children aged 0 to 17 years

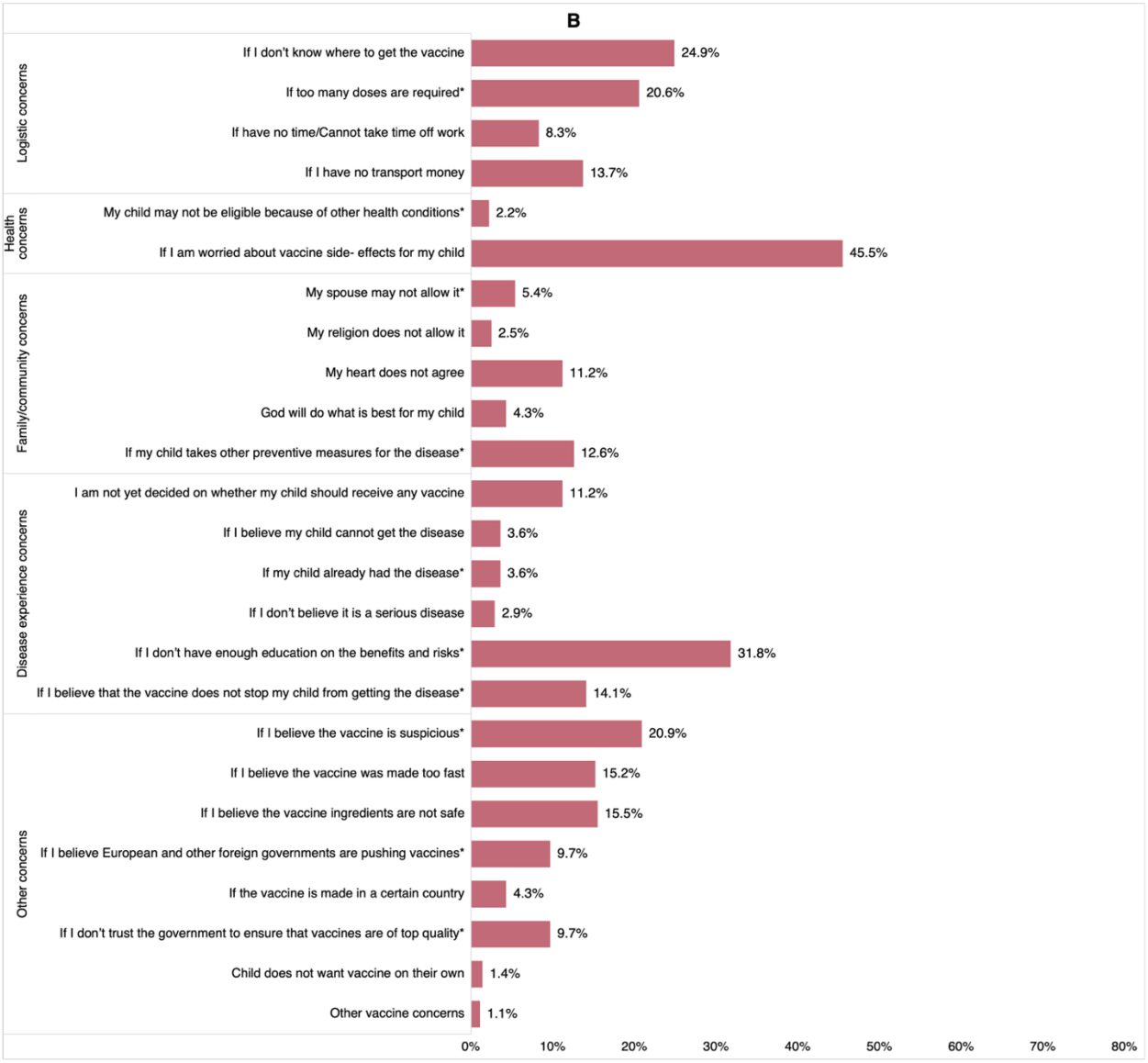
The most common reasons cited for vaccinating children against future diseases beyond COVID-19, including malaria, TB, HIV, pneumonia, influenza, and diarrheal disease, were protection from hospitalization or death (79.1%), protection against long-term effects of the disease (63.9%), and the general belief that vaccines are good for children (45.8%) (Figure 2A, Table S2A). Caregivers with ≥2 COVID-19 vaccine doses were more likely than unvaccinated caregivers to endorse vaccination for protection-related reasons, including hospitalization or death (82.4% vs. 68.4%, p=0.020), family protection (46.6% vs. 25.3%, p=0.006), potential economic/financial costs associated with the disease (38.9% vs 17.7%, p=0.005), and community protection (41.2% vs. 20.3%, p=0.002). HCWS were significantly more likely than community members to emphasize indirect benefits, including protecting family (59.1% vs. 30.3%, p<0.001), protecting the community (56.1% vs. 23.2%, p<0.001), and mitigating financial costs (51.5% vs. 23.7%, p<0.001). Few participants cited external pressures, such as government requirements (7.9%) or influence of family/friends (1.1%), and only 1.4% reported that vaccination was not relevant.

Reasons for not vaccinating among children aged 0 to 17 years

Caregivers reported a range of concerns about hypothetical vaccination for future or new vaccines (for their children, with variation by caregiver vaccine uptake and role (Figure 2B, Supplementary Table 2B). Health concerns were prominent, particularly fear of potential side effects (45.5%), reported more often by HCWs than community members (54.5% vs. 42.7%, p=0.090). Also, 31.8% reported insufficient knowledge about benefits and risks as a reason to not vaccinate, which was higher among HCWs than community members (42.4% vs. 28.4%, p=0.033). Logistic concerns included potential uncertainty about where to obtain the vaccine (24.9%), which was more common among caregivers with ≥2 doses compared to those unvaccinated (31.3% vs. 12.7%, p=0.009). Concerns about vaccine effectiveness and safety were also common: 14.1% believed vaccines would not prevent disease, more frequently among HCWs (25.8% vs. 10.4%, p=0.002), while 20.9% viewed vaccines as suspicious (31.8% vs. 17.5%, p=0.013). Distrust in government quality assurance was higher among HCWs (19.7% vs. 6.6%, p=0.002). Other concerns, such as beliefs about foreign influence (9.7%) or speed of development (15.2%), and safety of ingredients (15.5%) were also prevalent. While overall spousal disapproval of vaccination was an uncommon reason cited to not vaccinate (5.4%), HCWs were more likely to report spousal disapproval than community members (13.6% vs. 2.8%, p<0.001). Beliefs related to disease experience showed that caregivers whose child already had the disease were more likely to report this as a reason to not vaccinate (9.1% HCW vs. 1.9% community, p=0.006).

Figure 2. Hypothetical reasons for vaccinating or not vaccination children in the future against malaria, TB, HIV, pneumonia, influenza, updated/new COVID-19 booster, or diarrheal disease (n=277) A) Reasons for vaccinating children aged 0-17 years B) Reasons for not vaccinating children aged 0-17 years





*Significant differences between HCW and community members ($p<0.05$)

Current and trusted sources of vaccination information

Caregivers reported multiple sources of vaccine information (median 4 sources, interquartile range [IQR]: 3-6 sources), with television (80.1%), health facilities (68.6%), radio (62.8%), and social media (57.0%) being the most cited overall (Supplementary Table 3). Use of information sources differed significantly by caregiver COVID-19 vaccine dose status and caregiver role (community versus HCW). Caregivers with no vaccine doses reported overall significantly ($p<0.001$) less vaccine information sources (median 3 sources, IQR: 2-5 sources) compared to those with 1 or ≥2 doses (median 5 sources, IQR 3-6 sources), including less use of health facilities, television, radio, print media, or workplaces as vaccine information sources. HCW caregivers were significantly ($p<0.001$) more likely than community caregivers to report more vaccine information sources (HCW: 6 sources, IQR: 5-8 sources) vs community: 4 sources, IQR: 2-5 sources) overall including social media, health facilities, workplaces, print media, schools and churches (Supplementary Table 3).

Trusted sources of vaccine information also varied by caregiver COVID-19 doses and caregiver role. Overall, the ministry of health (86.6%) and healthcare professionals (66.8%) were the most trusted vaccine information sources among caregivers (Table S3). Caregivers with any COVID-19 vaccine doses trusted more ($p<0.001$) sources (median: 2 sources, IQR: 1-4) than those with no doses (median: 1 source, IQR: 1-2). Caregivers with no COVID-19 vaccine doses were significantly ($p=0.009$) less likely to trust government sources (38.0%) compared to those with any doses (1 dose, 55.1%) and ≥2 doses (59.5%) but had no significant differences in trust in the ministry of health and healthcare professionals for vaccine information. HCWs trusted more sources than community caregivers (HCW: 3 (IQR 2-5) vs community: 2 (IQR 1-3) ($p<0.001$)), including government, healthcare professionals, scientists, international organizations and district health offices. Trust in friends, family, religious leaders, and community leaders was relatively low, but was more common among HCWS compared to community members. Trust in social media (10.1%), political leaders (2.2%) and traditional healers (1.1%) was low.

Discussion

This secondary analysis among caregivers of children and adolescents in Lusaka, Zambia assessed attitudes and behaviours toward routine expanded programme on immunisation (EPI) and novel vaccines, including COVID-19 vaccination willingness for adolescents aged 12–17. Vaccine hesitancy, the reluctance or refusal to vaccinate despite availability of vaccines(24), is commonly understood through three interacting determinants: confidence, complacency, and convenience. Confidence, in particular, reflects trust in vaccine safety and effectiveness, in the health system and workers delivering them, and in the motives of policymakers who recommend them(25). While there were high uptake and perceived value of EPI vaccines, COVID-19 vaccination was low among adolescents 12 to 17, suggesting that caregiver hesitancy may be vaccine-specific rather than general, likely reflecting

lingering uncertainty about newer vaccines. Notably, caregivers' own COVID-19 vaccination status strongly predicted their children's uptake, pointing to personal experience, rather than knowledge alone, as a key driver of novel vaccine decisions for children. Combined with caregivers' trust in the Ministry of Health and healthcare professionals as vaccine information sources, these findings suggest that interventions to improve adolescent vaccine uptake should go beyond information to promote vaccine confidence among caregivers. Family-based strategies that engage already-vaccinated caregivers as peer champions, and that route messaging through the Ministry of Health and healthcare providers, may be more effective at building vaccine confidence and addressing hesitancy than generic education campaigns to influence uptake for future vaccination.

Caregivers considered EPI vaccines as widely important and recognized the importance of future vaccination of their children to protect them from hospitalization or death and the long-term effects of potential diseases. To our knowledge this is the first such data in our setting, and while comparability may be limited, similar trends have been noted across diverse settings. Similar reasons for vaccinating children were reported in a study in Myanmar, including wanting to keep children safe and less contagious (12). In contrast to our study where few participants (7.9%) cited external pressures (e.g., government requirements) as a reason to vaccinate, one study in the United States reported that top reasons for vaccination of children included being recommended by the child's doctor and feeling pressure that the doctor would think less of the caregiver if their children were not vaccinated (18%) (26). Messaging around the importance of vaccination to prevent hospitalization, death, and long-term illness is essential for future childhood vaccine campaigns, where caregivers view this information as an important driver of vaccination for their children.

While EPI vaccination was reportedly high, consistent with another Zambian study in which 93% of parents reported willingness to vaccinate their children against cholera (27), there was hesitancy around COVID-19 vaccination for children, with caregiver COVID-19 vaccination status associated with COVID-19 vaccination uptake among adolescents aged 12 to 17. We found that COVID-19 vaccine uptake among 12- to 17-year-olds was relatively low, with only 56% reporting that their child had received a COVID-19 vaccine dose, and 25% of caregivers reporting that they did not intend to vaccinate their children against COVID-19. A study in five West African countries found similar results, where only 36% of caregivers said that they would vaccinate their children for COVID-19 if a vaccine were made available to them, while 25% said they would refuse to vaccinate their children (28). Similarly, trends have been noted in the US, where caregivers who had received the COVID-19 vaccine were more likely to have their children vaccinated than caregivers who had not received the vaccine themselves (29). Results from 8 Eastern Mediterranean countries also showed that children were 5 times more likely to be vaccinated when their caregivers were vaccinated than when they were not (30). During child health week events, campaigns have been used to target zero-dose children; one example is the Big Catch-up campaign

316 in Zambia, which involved intensified outreach, community mobilization, and health service delivery (31). With
317 nearly a quarter of caregivers hesitant to vaccinate children for COVID-19, we highlight the potential for targeted
318 campaigns, such as the Big Catch-up, to inform caregivers about the importance of vaccinating children for future
319 novel vaccines and to address primary concerns driving hesitancy.

320 As more vaccines are being produced, health communication strategies should be family-based and focus on
321 providing caregivers with information on key issues of fear-based hesitancy identified, such as side effects, risks,
322 and the benefits of vaccination with new vaccines, to both reduce parents' vaccine-related fears and dispel
323 misinformation. Vaccine hesitancy around fears of potential side effects was a highly reported concern by 55%
324 of HCWs and 43% of community members. Similar findings in Myanmar showed that caregivers were hesitant
325 to vaccinate their children as they felt that young children might not be fit to get vaccinated against COVID-19,
326 as they were concerned about the perceived harmful effects of the vaccine (12). Concern about the speed at which
327 the vaccine was developed was another reason given to not vaccinate (26). Clarifying the risks and benefits of
328 side effects is crucial and requires sensitivity to parental concerns, as we know that parental vaccine status can
329 influence their decision to vaccinate their children. Addressing parental concerns using events such as Child health
330 week in Zambia can foster a positive perception of vaccines among caregivers, which, in turn, can influence their
331 decision to vaccinate their children. Events such as these can provide caregiver sensitization that precedes
332 vaccination by 3-6 months, allowing time to understand the risks and benefits and ensuring that trusted sources
333 deliver vaccine messaging.

334 Leveraging trusted sources such as the Ministry of Health and health professionals to deliver these messages is
335 crucial. Like our study, trust in HCWS to influence vaccine uptake was evident in a multi-country study done in
336 Nepal, Senegal, and Zambia, where community health workers work with the community to share information,
337 such as outreach and vaccine education (16). Doctors in the US were also seen as a trusted source of information,
338 especially from family members who are doctors (32). Vaccinated HCWS, as trusted vaccine sources, can work
339 with caregivers as community champions who can influence or encourage other caregivers to get their children
340 vaccinated. Unvaccinated HCWS, on the other hand, can negatively influence the community by undermining
341 vaccination campaigns through failing to recommend vaccines. That HCWs in our study reported concerns about
342 novel vaccines more often than community members, despite their high endorsement of established EPI vaccines,
343 complicates this champion role. It more likely reflects a reluctance to endorse a novel vaccine before the evidence
344 is in than broad hesitancy, but whether that caution is reassuring or a scepticism that could reach the communities
345 they serve, our data cannot resolve. Either way, HCW confidence in a new vaccine cannot be assumed and should
346 be built ahead of rollout. Ministry of Health-branded messages and vaccinated HCWS as champions can be used
347 to positively influence vaccine uptake in both unvaccinated HCWs and community members.

Strengths and Limitations

Our study has several key strengths. The sample of both HCWs and community members provides insight into vaccination patterns and primary concerns for caregivers not only in the community but among HCWs who are trusted sources of vaccine information. The study has also provided valuable insights into the influence that caregivers can have on vaccine uptake among adolescents, offering a foundation for actionable health strategies to enhance immunizations through caregiver-targeted efforts.

Our study is not without limitations. While our sample population was recruited from ten health facilities and four diverse communities, all participants were from Lusaka, an urban city, with no rural representation, making our findings not generalizable to all parts of Zambia. The study relied on self-reporting of vaccination status among children and caregivers and may not reflect actual vaccine uptake. There could be potential social desirability bias to indicate more uptake of COVID-19 vaccine doses, however, the research assistants were experienced in collecting sensitive information and trained to build rapport with the participants in a way that encourages open and honest responses. Importantly, we recognize that adolescents themselves may have decision-making around their vaccination, and due to the nature of the study, we did not directly enrol or collect data from adolescents to explore their personal views on why they may or may not choose vaccination.

Conclusion

Vaccine confidence among caregivers in this setting was specific rather than general, with established childhood vaccines remaining well accepted, and COVID-19 and future novel vaccines lower and shaped by caregivers' COVID-19 vaccination behaviour. The task for future vaccine introduction is therefore to address the fear of side effects and the gaps in information on the risks and benefits highlighted by caregivers rather than confronting a broad hesitancy that our data do not show. Targeted campaigns aimed at caregivers in Zambia should leverage trusted sources, including the Ministry of Health and healthcare professionals, with clear information.

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Supplementary Data

Table S1. Vaccine history and intentions among caregivers and for children, by caregiver COVID-19 vaccination and role

		COVID-19 Vaccine Doses in Caregiver				Caregiver Role		
	Total N=277	≥2 doses N=131	1 dose N=67	0 doses N=79	p-value	Community N=211	HCW N=66	p-value
General Vaccines								
Importance of vaccines for child's health					0.42			0.80
Not at all important	8 (2.9%)	1 (0.8%)	4 (6.0%)	3 (3.8%)		1 (1.5%)	7 (3.3%)	
A little important	1 (0.4%)	1 (0.8%)	0 (0.0%)	0 (0.0%)		0 (0.0%)	1 (0.5%)	
Moderately important	10 (3.6%)	4 (3.1%)	3 (4.5%)	3 (3.8%)		2 (3.0%)	8 (3.8%)	
Very important	258 (93.1%)	125 (95.4%)	60 (89.6%)	73 (92.4%)		63 (95.5%)	195 (92.4%)	
Did not have child get a recommended EPI vaccine					0.58			0.68
Yes	17 (6.1%)	8 (6.1%)	6 (9.0%)	3 (3.8%)		4 (6.1%)	13 (6.2%)	
No	258 (93.1%)	122 (93.1%)	60 (89.6%)	76 (96.2%)		61 (92.4%)	197 (93.4%)	
Unsure	2 (0.7%)	1 (0.8%)	1 (1.5%)	0 (0.0%)		1 (1.5%)	1 (0.5%)	
Caregiver COVID-19 Vaccines								
How long after COVID-19 vaccine became available did you get your first dose					0.016			0.15
<6 months	75 (37.9%)	56 (42.7%)	19 (28.4%)	-		52 (38.5%)	23 (36.5%)	
6-12 months	56 (28.3%)	40 (30.5%)	16 (23.9%)	-		32 (23.7%)	24 (38.1%)	
12+ months	35 (17.7%)	16 (12.2%)	19 (28.4%)	-		26 (19.3%)	9 (14.3%)	
I'm not sure	32 (16.2%)	19 (14.5%)	13 (19.4%)	-		25 (18.5%)	7 (11.1%)	
Intention to get additional COVID-19 vaccine doses or booster?					<0.001			<0.001
Yes, when I know they are in stock and I can receive one	115 (41.5%)	59 (45.0%)	30 (44.8%)	26 (32.9%)		94 (44.5%)	21 (31.8%)	
Not sure/still thinking about it	52 (18.8%)	15 (11.5%)	18 (26.9%)	19 (24.1%)		44 (20.9%)	8 (12.1%)	
Only if required	59 (21.3%)	41 (31.3%)	7 (10.4%)	11 (13.9%)		32 (15.2%)	27 (40.9%)	
No, I will never take additional doses of the COVID-19 vaccine	33 (11.9%)	12 (9.2%)	8 (11.9%)	13 (16.5%)		25 (11.8%)	8 (12.1%)	
Prefer not to answer	18 (6.5%)	4 (3.1%)	4 (6.0%)	10 (12.7%)		16 (7.6%)	2 (3.0%)	
Ease of getting COVID-19 vaccine or booster if desired								0.60
Very easy	97 (74.0%)	97 (74.0%)	-	-		65 (75.6%)	32 (71.1%)	
Fairly easy	18 (13.7%)	18 (13.7%)	-	-		9 (10.5%)	9 (20.0%)	
Neither easy nor difficult	4 (3.1%)	4 (3.1%)	-	-		3 (3.5%)	1 (2.2%)	
Fairly difficult	7 (5.3%)	7 (5.3%)	-	-		5 (5.8%)	2 (4.4%)	
Very difficult	5 (3.8%)	5 (3.8%)	-	-		4 (4.7%)	1 (2.2%)	
Adolescent COVID-19 Vaccines (Age 12-17 Years)	N=150							
At least one COVID-19 dose in child 12-17 (n=150)					0.003			0.32
Yes	87 (58.0%)	53 (71.6%)	19 (54.3%)	15 (36.6%)		61 (54.5%)	26 (68.4%)	
No	57 (38.0%)	20 (27.0%)	15 (42.9%)	22 (53.7%)		46 (41.1%)	11 (28.9%)	
Prefer not to answer	6 (4.0%)	1 (1.4%)	1 (2.9%)	4 (9.8%)		5 (4.5%)	1 (2.6%)	
Intention to vaccinate for COVID-19 in child 12-17 if not vaccinated (n=57)					0.074			0.26
In the next 6 months	9 (15.8%)	4 (20.0%)	4 (26.7%)	1 (4.5%)		7 (15.2%)	2 (18.2%)	
Between 6-12 months	3 (5.3%)	2 (10.0%)	1 (6.7%)	0 (0.0%)		1 (2.2%)	2 (18.2%)	
More than a year	2 (3.5%)	1 (5.0%)	0 (0.0%)	1 (4.5%)		2 (4.3%)	0 (0.0%)	
Only if required	29 (50.9%)	12 (60.0%)	8 (53.3%)	9 (40.9%)		23 (50.0%)	6 (54.5%)	
Never	8 (14.0%)	0 (0.0%)	1 (6.7%)	7 (31.8%)		7 (15.2%)	1 (9.1%)	
Prefer not to answer	6 (10.5%)	1 (5.0%)	1 (6.7%)	4 (18.2%)		6 (13.0%)	0 (0.0%)	

EPI, Expanded Programme on Immunization (EPI) (for diphtheria, tetanus, pertussis, measles, polio, TB); HCW, healthcare worker

Table S2A. Hypothetical reasons for vaccinating children in the future against malaria, TB, HIV, pneumonia, influenza, updated/new COVID-19 booster, or diarrheal disease (n=277)

	Total (n=277)	COVID-19 Vaccine Doses in Caregiver				Caregiver Role		
		≥2 doses (n=131)	1 dose (n=67)	0 doses (n=79)	p-value	HCW (n=66)	Community (n=211)	p-value
Reasons for vaccinating child								
Protects child from potential hospitalization/death	219 (79.1%)	108 (82.4%)	57 (85.1%)	54 (68.4%)	0.020	56 (84.8%)	163 (77.3%)	0.19
Protects child against the long-term effects of the disease	177 (63.9%)	94 (71.8%)	34 (50.7%)	49 (62.0%)	0.013	51 (77.3%)	126 (59.7%)	0.010
Help protect other family members from the disease	103 (37.2%)	61 (46.6%)	22 (32.8%)	20 (25.3%)	0.006	39 (59.1%)	64 (30.3%)	<0.001
Help protect members of the community from the disease	86 (31.0%)	54 (41.2%)	16 (23.9%)	16 (20.3%)	0.002	37 (56.1%)	49 (23.2%)	<0.001
Protects against potential economic/financial costs associated with the disease	84 (30.3%)	51 (38.9%)	19 (28.4%)	14 (17.7%)	0.005	34 (51.5%)	50 (23.7%)	<0.001
Government requirement	22 (7.9%)	14 (10.7%)	4 (6.0%)	4 (5.1%)	0.27	8 (12.1%)	14 (6.6%)	0.15
Vaccines are good for children	127 (45.8%)	67 (51.1%)	30 (44.8%)	30 (38.0%)	0.18	37 (56.1%)	90 (42.7%)	0.056
Family and friends want me to	3 (1.1%)	3 (2.3%)	0 (0.0%)	0 (0.0%)	0.18	1 (1.5%)	2 (0.9%)	0.70
Other, specify:	3 (1.1%)	2 (1.5%)	1 (1.5%)	0 (0.0%)	0.55	0 (0.0%)	3 (1.4%)	0.33
I have vaccinated myself and want to protect my children the same way	2 (0.7%)	1 (0.4%)	1 (0.4%)	0 (0.0%)		0 (0.0%)	2 (0.7%)	
Not relevant, I would not vaccinate my child	4 (1.4%)	0 (0.0%)	1 (1.5%)	3 (3.8%)	0.082	1 (1.5%)	3 (1.4%)	0.96

Table S2B. Hypothetical reasons for not vaccinating children in the future against malaria, TB, HIV, pneumonia, influenza, updated/new COVID-19 booster, or diarrheal disease (n=277)

		COVID-19 Vaccine Doses in Caregiver				Caregiver Role		
	Total (n=277)	≥2 doses (n=131)	1 dose (n=67)	0 doses (n=79)	p-value	HCW (n=66)	Community (n=211)	p-value
Logistic concerns								
If I don't know where to get the vaccine	69 (24.9%)	41 (31.3%)	18 (26.9%)	10 (12.7%)	0.009	16 (24.2%)	53 (25.1%)	0.89
If too many doses are required	57 (20.6%)	28 (21.4%)	11 (16.4%)	18 (22.8%)	0.61	25 (37.9%)	32 (15.2%)	<0.001
If have no time/Cannot take time off work	23 (8.3%)	15 (11.5%)	5 (7.5%)	3 (3.8%)	0.14	5 (7.6%)	18 (8.5%)	0.81
If I have no transport money	38 (13.7%)	22 (16.8%)	8 (11.9%)	8 (10.1%)	0.35	11 (16.7%)	27 (12.8%)	0.43
Health concerns								
My child may not be eligible because of other health conditions (e.g., TB, sickle cell, heart condition, very sick, allergies)	6 (2.2%)	3 (2.3%)	1 (1.5%)	2 (2.5%)	0.90	4 (6.1%)	2 (0.9%)	0.013
If I am worried about vaccine side- effects for my child	126 (45.5%)	63 (48.1%)	31 (46.3%)	32 (40.5%)	0.56	36 (54.5%)	90 (42.7%)	0.090
Family/community concerns								
My spouse may not allow it	15 (5.4%)	8 (6.1%)	6 (9.0%)	1 (1.3%)	0.11	9 (13.6%)	6 (2.8%)	<0.001
My religion does not allow it	7 (2.5%)	5 (3.8%)	1 (1.5%)	1 (1.3%)	0.43	3 (4.5%)	4 (1.9%)	0.23
My heart does not agree	31 (11.2%)	12 (9.2%)	7 (10.4%)	12 (15.2%)	0.40	9 (13.6%)	22 (10.4%)	0.47
God will do what is best for my child	12 (4.3%)	5 (3.8%)	4 (6.0%)	3 (3.8%)	0.75	4 (6.1%)	8 (3.8%)	0.43
If my child takes other preventive measures for the disease	35 (12.6%)	21 (16.0%)	5 (7.5%)	9 (11.4%)	0.21	13 (19.7%)	22 (10.4%)	0.048
Disease experience concerns								
I am not yet decided on whether my child should receive any vaccine	31 (11.2%)	14 (10.7%)	8 (11.9%)	9 (11.4%)	0.96	9 (13.6%)	22 (10.4%)	0.47
If I believe my child cannot get the disease	10 (3.6%)	4 (3.1%)	3 (4.5%)	3 (3.8%)	0.87	3 (4.5%)	7 (3.3%)	0.64
If my child already had the disease	10 (3.6%)	4 (3.1%)	5 (7.5%)	1 (1.3%)	0.12	6 (9.1%)	4 (1.9%)	0.006
If I don't believe it is a serious disease	8 (2.9%)	3 (2.3%)	2 (3.0%)	3 (3.8%)	0.82	3 (4.5%)	5 (2.4%)	0.36
If I don't have enough education on the benefits and risks	88 (31.8%)	49 (37.4%)	18 (26.9%)	21 (26.6%)	0.16	28 (42.4%)	60 (28.4%)	0.033
If I believe that the vaccine does not stop my child from getting the disease	39 (14.1%)	22 (16.8%)	7 (10.4%)	10 (12.7%)	0.44	17 (25.8%)	22 (10.4%)	0.002
Other concerns								
If I believe the vaccine is suspicious	58 (20.9%)	27 (20.6%)	11 (16.4%)	20 (25.3%)	0.42	21 (31.8%)	37 (17.5%)	0.013
If I believe the vaccine was made too fast	42 (15.2%)	21 (16.0%)	8 (11.9%)	13 (16.5%)	0.70	12 (18.2%)	30 (14.2%)	0.43
If I believe the vaccine ingredients are not safe	43 (15.5%)	22 (16.8%)	10 (14.9%)	11 (13.9%)	0.85	14 (21.2%)	29 (13.7%)	0.14
If I believe European and other foreign governments are pushing vaccines	27 (9.7%)	12 (9.2%)	7 (10.4%)	8 (10.1%)	0.95	13 (19.7%)	14 (6.6%)	0.002
If the vaccine is made in a certain country	12 (4.3%)	8 (6.1%)	2 (3.0%)	2 (2.5%)	0.39	4 (6.1%)	8 (3.8%)	0.43
If I don't trust the government to ensure that vaccines are of top quality	27 (9.7%)	12 (9.2%)	9 (13.4%)	6 (7.6%)	0.47	13 (19.7%)	14 (6.6%)	0.002
Child does not want vaccine on their own	4 (1.4%)	0 (0.0%)	1 (1.5%)	3 (3.8%)	0.082	0 (0.0%)	4 (1.9%)	0.26
Other vaccine concerns	3 (1.1%)	1 (0.8%)	1 (1.5%)	1 (1.3%)	0.88	0 (0.0%)	3 (1.4%)	0.33

Table S3. Current sources of vaccine-related information and trusted vaccine sources (n=277)

	Total (n=277)	COVID-19 Vaccine Doses in Caregiver				Caregiver Role			COVID-19 Vaccination Status (at Least One Dose) in Children 12-17		
		≥2 doses (n=131)	1 dose (n=67)	0 doses (n=79)	p-value	HCW (n=66)	Community (n=211)	p-value	Child vaccinated (n=87)	Child not vaccinated (n=57)	p-value
Current sources for vaccine information											
Social media	158 (57.0%)	78 (59.5%)	37 (55.2%)	43 (54.4%)	0.72	54 (81.8%)	104 (49.3%)	<0.001	47 (54.0%)	29 (50.9%)	0.71
TV	222 (80.1%)	110 (84.0%)	57 (85.1%)	55 (69.6%)	0.021	57 (86.4%)	165 (78.2%)	0.15	74 (85.1%)	46 (80.7%)	0.49
Radio	174 (62.8%)	92 (70.2%)	42 (62.7%)	40 (50.6%)	0.017	50 (75.8%)	124 (58.8%)	0.013	57 (65.5%)	38 (66.7%)	0.89
Print media	57 (20.6%)	32 (24.4%)	17 (25.4%)	8 (10.1%)	0.025	27 (40.9%)	30 (14.2%)	<0.001	17 (19.5%)	10 (17.5%)	0.76
Community/Word of mouth	147 (53.1%)	74 (56.5%)	29 (43.3%)	44 (55.7%)	0.18	35 (53.0%)	112 (53.1%)	0.99	47 (54.0%)	32 (56.1%)	0.80
Health facility	190 (68.6%)	99 (75.6%)	52 (77.6%)	39 (49.4%)	<0.001	60 (90.9%)	130 (61.6%)	<0.001	65 (74.7%)	35 (61.4%)	0.090
Church	148 (53.4%)	75 (57.3%)	38 (56.7%)	35 (44.3%)	0.16	44 (66.7%)	104 (49.3%)	0.014	54 (62.1%)	31 (54.4%)	0.36
School	46 (16.6%)	26 (19.8%)	13 (19.4%)	7 (8.9%)	0.091	20 (30.3%)	26 (12.3%)	<0.001	13 (14.9%)	8 (14.0%)	0.88
Place of work	98 (35.4%)	58 (44.3%)	26 (38.8%)	14 (17.7%)	<0.001	53 (80.3%)	45 (21.3%)	<0.001	30 (34.5%)	24 (42.1%)	0.36
Total number of current sources	4 (3-6)	5 (3-6)	5 (3-6)	3 (2-5)	<0.001	6 (5-8)	4 (2-5)	<0.001	5 (3-6)	4 (3-6)	0.56
Trusted sources for vaccine information											
Government	145 (52.3%)	78 (59.5%)	37 (55.2%)	30 (38.0%)	0.009	50 (75.8%)	95 (45.0%)	<0.001	52 (59.8%)	29 (50.9%)	0.29
Political leaders	6 (2.2%)	6 (4.6%)	0 (0.0%)	0 (0.0%)	0.033	4 (6.1%)	2 (0.9%)	0.013	2 (2.3%)	3 (5.3%)	0.34
Vaccine developers	49 (17.7%)	29 (22.1%)	12 (17.9%)	8 (10.1%)	0.087	22 (33.3%)	27 (12.8%)	<0.001	13 (14.9%)	7 (12.3%)	0.65
Health care professionals	185 (66.8%)	94 (71.8%)	45 (67.2%)	46 (58.2%)	0.13	53 (80.3%)	132 (62.6%)	0.008	52 (59.8%)	41 (71.9%)	0.14
Scientists	50 (18.1%)	28 (21.4%)	14 (20.9%)	8 (10.1%)	0.095	25 (37.9%)	25 (11.8%)	<0.001	19 (21.8%)	8 (14.0%)	0.24
Friends and family	31 (11.2%)	18 (13.7%)	9 (13.4%)	4 (5.1%)	0.12	13 (19.7%)	18 (8.5%)	0.012	13 (14.9%)	6 (10.5%)	0.44
Newspapers/magazines	32 (11.6%)	18 (13.7%)	8 (11.9%)	6 (7.6%)	0.40	12 (18.2%)	20 (9.5%)	0.054	7 (8.0%)	6 (10.5%)	0.61
Religious leader	54 (19.5%)	31 (23.7%)	14 (20.9%)	9 (11.4%)	0.089	21 (31.8%)	33 (15.6%)	0.004	19 (21.8%)	13 (22.8%)	0.89
Community leader (e.g. elder or chief)	36 (13.0%)	22 (16.8%)	9 (13.4%)	5 (6.3%)	0.091	16 (24.2%)	20 (9.5%)	0.002	13 (14.9%)	6 (10.5%)	0.44
International organizations (e.g. WHO)	68 (24.5%)	40 (30.5%)	13 (19.4%)	15 (19.0%)	0.090	28 (42.4%)	40 (19.0%)	<0.001	27 (31.0%)	16 (28.1%)	0.70
Social media	28 (10.1%)	19 (14.5%)	5 (7.5%)	4 (5.1%)	0.063	11 (16.7%)	17 (8.1%)	0.043	8 (9.2%)	7 (12.3%)	0.55
District Health Office	135 (48.7%)	73 (55.7%)	28 (41.8%)	34 (43.0%)	0.087	37 (56.1%)	98 (46.4%)	0.17	48 (55.2%)	23 (40.4%)	0.082
Ministry of Health	240 (86.6%)	119 (90.8%)	55 (82.1%)	66 (83.5%)	0.15	61 (92.4%)	179 (84.8%)	0.11	76 (87.4%)	50 (87.7%)	0.95
Community volunteers	80 (28.9%)	46 (35.1%)	17 (25.4%)	17 (21.5%)	0.084	28 (42.4%)	52 (24.6%)	0.005	34 (39.1%)	13 (22.8%)	0.042
Traditional healers (e.g. witch doctors)	3 (1.1%)	2 (1.5%)	1 (1.5%)	0 (0.0%)	0.55	1 (1.5%)	2 (0.9%)	0.70	1 (1.1%)	1 (1.8%)	0.76
Other	2 (0.7%)	0 (0.0%)	0 (0.0%)	2 (2.5%)	0.080	0 (0.0%)	2 (0.9%)	0.43	0 (0.0%)	1 (1.8%)	0.22
Total number of trusted sources	2 (1-3)	2 (1-4)	2 (1-4)	1 (1-2)	<0.001	3 (2-5)	2 (1-3)	<0.001	2 (1-3)	2 (1-4)	0.73