

Uptake of the COVID-19 vaccine among healthcare workers in Malawi

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Background: Little is known about coronavirus disease 2019 (COVID-19) vaccination in Africa. We sought to understand Malawian healthcare workers' (HCWs') COVID-19 vaccination and its hypothesized determinants.

Methods: In March 2021, as the COVID-19 vaccine roll-out commenced in Malawi, we surveyed clinical and lay cadre HCWs (n=400) about their uptake of the vaccine and potential correlates (informed by the WHO Behavioral and Social Drivers of COVID-19 Vaccination framework). We analyzed uptake and used adjusted multivariable logistic regression models to explore how 'what people think and feel' constructs were associated with HCWs' motivation to be vaccinated.

Results: Of the surveyed HCWs, 82.5% had received the first COVID-19 vaccine dose. Motivation (eagerness to be vaccinated) was strongly associated with confidence in vaccine benefits (adjusted OR [aOR] 9.85, 95% CI 5.50 to 17.61) and with vaccine safety (aOR 4.60, 95% CI 2.92 to 7.23), but not with perceived COVID-19 infection risk (aOR 1.38, 95% CI 0.88 to 2.16). Of all the information sources about COVID-19 vaccination, 37.5% were reportedly negative in tone.

Conclusions: HCWs in Malawi have a high motivation to be vaccinated and a high COVID-19 vaccine uptake. Disseminating vaccine benefits and safety messages via social media and social networks may be persuasive for individuals who are unmotivated to be vaccinated and less likely to accept the COVID-19 vaccine.

Keywords: COVID-19, healthcare workers, vaccine hesitancy, vaccines.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has caused >5.9 million deaths worldwide at the time of writing, and its destruction is far from over.¹ Countries in Southern Africa have experienced catastrophic recent increases in cases ('waves').² The case fatality ratio appears to be highest in low-income countries, potentially reflecting weaker health systems with less capacity to manage COVID-19 complications, as well as a high prevalence of potentially exacerbating conditions including HIV, TB and chronic comorbidities.³

High COVID-19 vaccine coverage in low- and middle-income countries is likely to be extremely cost-effective and save millions of lives.⁴ There are however major global inequities in access to COVID-19 vaccines,^{5,6} and gaps in our knowledge of factors likely to be associated with COVID-19 vaccine uptake and acceptability, which has primarily come from high-income coun-

tries.^{7,8} The scant literature about COVID-19 vaccination from Africa to date has focused on COVID-19 vaccine acceptability and hesitancy rather than actual vaccination behaviors.^{9–12} A recent pooled analysis found that 80% of survey respondents from low- and middle-income countries expressed a willingness to be vaccinated,¹³ but data from Africa about COVID-19 vaccine uptake are still very limited. Although attitudes are an important precursor to vaccination behavior, stated acceptability may not correlate with actual uptake and different factors may influence acceptability vs uptake.^{14,15} It is therefore essential to study behavior (vaccine uptake) as well as the full range of potential drivers, including attitudes and their determinants.

The Ministry of Health (MOH) has reported >63 000 COVID-19 cases and 2311 deaths (a case fatality rate of 3.6%)¹⁶ in Malawi (as of 16 December 2021), although testing is limited and findings from elsewhere in Africa indicate that the actual seroprevalence may be much higher.^{17,18} Several factors have potentially

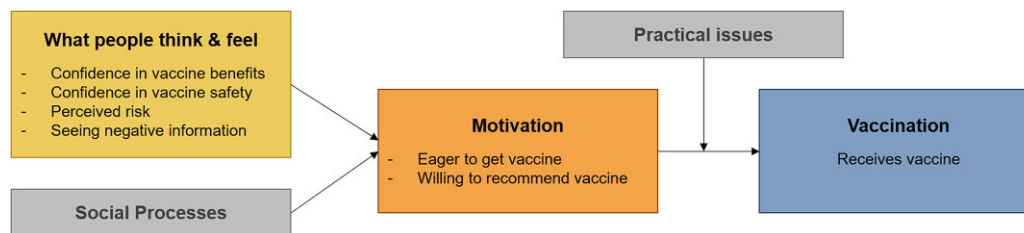


Figure 1. Conceptual framework for this study, adapted from the WHO BeSD framework of COVID-19 vaccination.²⁷ Boxes in gray are constructs unmeasured in this study.

exacerbated Malawi's COVID-19 situation, including proximity to very high-burden countries like South Africa,² low knowledge and perceived risk of COVID-19¹⁹ and limited uptake of preventive measures like mask-wearing.²⁰ On 5 March 2021, the first COVID-19 vaccine doses arrived in Malawi²¹; nearly 980 000 first doses, and 366 000 second doses, of the Serum Institute-AstraZeneca COVID-19 vaccine (COVISHIELD), had been distributed nationally as of 16 December 2021.^{16,21} As there are nearly 10 million adult Malawians, COVID-19 vaccine availability is relatively limited to date.

Given the scarcity of information from low-income countries about factors related to the uptake of, and attitudes toward, the COVID-19 vaccine, we undertook a survey of Malawian health-care workers (HCWs) as the vaccine was being introduced, because these individuals were prioritized for vaccination.²¹ Achieving high COVID-19 vaccine coverage among HCWs is important because HCWs are at an elevated risk of infection, are essential to ensure continuity of safe medical service provision,^{22,23} and they strongly influence vaccine uptake among their patients.^{24–26}

The objective of this analysis was to identify correlates of vaccine uptake and motivation among HCWs in Malawi, informed by the WHO behavioral and social drivers (BeSD) framework of COVID-19 vaccination.²⁷

Materials and Methods

Study design

This was a cross-sectional survey of HCWs in Malawi, informed by the WHO BeSD framework, as it has been adapted for COVID-19 vaccination among HCWs (Figure 1).²⁷

Site and participant selection

We recruited and surveyed HCWs from 32 health facilities in Central and Southern Malawi. Sites were selected purposefully from among those supported by the Partners in Hope HIV Care and Treatment program to include government community hospitals (n=3, all rural) and district hospitals (n=6, all urban/peri-urban), faith-based hospitals run by the Christian Health Association of Malawi (n=7, three urban/peri-urban and four rural) and larger health centers (n=16, all rural except for one urban/peri-urban). Beginning on 15 March 2021, all HCWs at these sites were offered the Serum Institute-AstraZeneca COVISHIELD vaccine. Vaccination was optional and was offered on-site free of charge.

At each site, we identified eligible respondents: HCWs (stratified into clinical and non-clinical cadres, including Partners in Hope staff and government employees) aged ≥ 18 y who provided outpatient HIV care during the 3 mo preceding data collection and did not provide COVID-19 care. Clinical providers included physicians, clinical officers (who complete 3 y of training and a 1-y internship), medical assistants (who complete 2 y of training) and nurses. Non-clinical cadres included workers who support HIV treatment, counseling, health promotion and community-based care (i.e. HIV diagnostic assistants [HDAs], health surveillance assistants [HSAs] and patient supporters), as well as data clerks and antiretroviral therapy (ART) clerks, who are involved in data entry and reporting. At each facility, we generated a census of individuals and selected one at random per stratum to invite for participation; we repeated this process until up to 14 participants per facility were invited to participate.

Data collection

The survey tool incorporated modules from the OCEANS study, which surveyed British adults about their attitudes toward the COVID-19 vaccine²⁸; and from the Vaccine Hesitancy Scale.²⁹ We also asked respondents about their experiences with COVID-19, sources of information about COVID-19 vaccine and demographic information. The survey instrument was developed in English, translated to Chichewa, then back-translated to English; bilingual (English-Chichewa) members of the research team reviewed and revised the Chichewa-language tool to ensure correct meaning and intention. The survey was administered in private spaces by a trained research assistant using the SurveyCTO mobile data collection platform on an Android tablet. Research assistants read each survey question aloud to each respondent and logged all responses. All respondents gave oral informed consent before beginning the survey. Data were collected completely anonymously, with no names or identifying information that could be traced to the individual by Partners in Hope or their employer. Data were collected from 31 March to 5 May 2021.

Key variables and outcomes

The outcome of vaccine uptake ('vaccination' in the BeSD framework) was defined as a self-reported receipt of a COVID-19 vaccine dose. At the time of this survey, as vaccine distribution had recently commenced, no respondent was yet eligible for a second vaccine dose. People who reported an upcoming vaccine

appointment, or being ineligible for the vaccine per Malawi MOH guidelines (pregnant and breastfeeding women, under the age of eligibility, or recent COVID-19 infection), were excluded from this analysis. People who had been offered but had not received the COVID-19 vaccine were therefore considered ‘decliners’ if they did not self-report ineligibility as per the guidelines.

The intermediate outcome of ‘motivation’ was operationalized based on survey responses as: (1) whether the respondent was eager or willing to receive the COVID-19 vaccine (vs not bothered about, unwilling to or extremely opposed to receiving it); and (2) whether the respondent would encourage family or friends who were thinking of getting the COVID-19 vaccine (vs would not say anything, would ask them to delay or would suggest they should not get the vaccine).

Respondents were classified as having ‘confidence in vaccine benefits’ if they reported: (1) the COVID-19 vaccine would save a lot of lives (vs save some lives or have no impact); and (2) the COVID-19 vaccine would strengthen their immune system (vs would weaken or have no effect on their immune system). ‘Confidence in vaccine safety’ was measured through survey questions about whether rapidly developed vaccines are unsafe and anticipated prevalence and severity of short- and long-term side effects from the COVID-19 vaccine. Respondents with ‘high perceived risk’ were those who thought they definitely, probably or possibly would be infected with COVID-19 in the next 12 mo (vs probably not or definitely not) and those who thought that they would get very ill from COVID-19 (vs have mild flu or symptoms that would hardly be noticeable).

Respondents were asked whether they had heard any information or opinions about any COVID-19 vaccine from each of a variety of sources (including family, media, religious leaders) and, if so, whether they would characterize the information/opinions from that source as overall positive, overall negative or neutral. No timeframe was specified for these questions. Each respondent was given a negative information exposure ‘score’ (1 point per negative information source) and a negative information ‘share’, that is, the percentage of all information sources seen/heard that was reportedly negative in tone. (As all respondents had been offered the vaccine and knew someone vaccinated, this analysis did not measure constructs related to ‘social processes’ or ‘practical issues’ from the WHO BeSD framework.)

Data analysis

We first estimated COVID-19 vaccine uptake for the full sample and by respondent characteristic (gender, age, job title/cadre, number of comorbidities [zero, one or more than one of high blood pressure, diabetes, lung or heart disease] and underlying vaccine hesitancy [proxied by whether the respondent expressed concern about the safety of routine childhood vaccines]). We then calculated the correlation between having high motivation (as defined above) and uptake of the vaccine. Based on multivariable logistic regression models that included respondent characteristics, we estimated the marginal probability that more or less motivated individuals had been vaccinated. Next, through a series of multivariable logistic regression models, we assessed whether ‘what people think and feel’ was correlated with motivation to be vaccinated (as described above). Lastly, we calculated the ‘prevalence’ of exposure to negative information about the COVID-19

vaccine by source. All the regression models included standard errors clustered at the sampling level (health facility).

Results

A total of 435 surveys were completed; 35 responses were excluded from this analysis as they were ineligible for COVID-19 vaccination or had an upcoming appointment to be vaccinated, resulting in an analytical sample of 400 respondents.

Description of the sample

The respondents’ median age was 32 (IQR: 28, 38) y and 77.8% reported no comorbidities (such as high blood pressure, diabetes, lung or heart disease) (Table 1). Approximately one-third of respondents were clinical staff (physicians, clinical officers, nurses and medical assistants) and the remainder were lay cadres involved in health promotion, counseling and community-based care (HDAs, HSAs, patient supporters, ART clerks and data clerks) (Table 1).

Over two-thirds of respondents (n=284, 71.0%) knew someone who had died from COVID-19, most commonly a friend or acquaintance (n=199), a family member outside the household (n=52), a patient/client (n=52) or a coworker (n=48). Fifty respondents (12.5%) said they had been infected with COVID-19, but only 15 of these were reportedly laboratory-confirmed cases.

Uptake of the COVID-19 vaccine

Most respondents (82.5%, n=330) had received one dose of the COVID-19 vaccine by the time of the survey, and 17.5% (n=70) had declined the vaccine. No relationships between vaccine uptake and demographic or background characteristics were significant at the $p < 0.05$ level, although some suggestive findings emerged (Supplementary Table 1). Uptake was lower among lay cadres (79.9% vs 87.6% of clinical staff), younger respondents (74.2% of those aged 20–29 y vs >85% among respondents aged >30 y), people without any comorbidities (81.4% vs 86.5% among people with one or more comorbidities) and people who were concerned about the safety of routine childhood vaccines (66.7% vs 83.4% among those who were not concerned).

Among respondents who had received one COVID-19 vaccine dose, nearly all (n=312, 94.5%) intended to receive a second dose (second doses had not commenced at the time of the survey). After receiving the first vaccine dose, 20.3% of respondents said they experienced no side effects (n=67), 29.1% experienced mild side effects (n=96), 42.1% experienced moderate side effects (n=139) and 8.5% experienced severe side effects (n=28).

The most common reasons for declining vaccination were a fear of side effects (n=36), challenges with vaccine supply/access (n=8), not feeling that the vaccine is necessary (n=7) and still feeling unsure/undecided (n=7).

Motivation towards the COVID-19 vaccine

Overall, 59.8% of respondents were eager or willing to be vaccinated and 85.8% said they would encourage friends or family to get the vaccine (Table 2, Supplementary Figure 1). Both types of

Table 1. Description of the sample

	n (%)
Gender	
Female	179 (44.8%)
Male	221 (55.3%)
Age, y	
Average (range)	33.8 (20-60)
Median (IQR)	32 (28, 38)
Cadre	
Physician or clinical officer	34 (8.5%)
Medical assistant	32 (8.0%)
Nurse	71 (17.8%)
HDA/HSA ¹	104 (26.0%)
Patient supporter	83 (20.8%)
Data clerk	69 (17.3%)
ART clerk	7 (1.8%)
Number of comorbidities ²	
0	311 (77.8%)
1	58 (14.5%)
≥2	31 (7.8%)
Underlying attitudes towards childhood vaccines	
Agree (vs disagree or don't know) that: Childhood vaccines are effective	397 (99.3%)
Agree (vs disagree or don't know) that: Having children vaccinated is important for the health of people in the community	398 (99.5%)
Agree (vs disagree or don't know) that: Getting vaccines is a good way to protect children from disease	398 (99.5%)
Agree (vs disagree or don't know) that: I am concerned about serious adverse effects of childhood vaccines	21 (5.3%)
Total	400 (100%)

¹HDA, HIV diagnostic assistant; HSA, health surveillance assistant.

²High blood pressure, diabetes, lung or heart disease.

Table 2. Associations between motivation and vaccination behavior (n=400)

	n (%) expressing this	aOR vaccine uptake (vs decline), 95% CI
Willing or eager to be vaccinated (vs not bothered, unwilling, opposed)	239 (59.8%)	12.22 ^{***} (5.48 to 27.22)
Would encourage friends/family to vaccinate (vs not say anything, ask them to delay)	343 (85.8%)	16.54 ^{***} (9.36 to 29.22)

aOR includes: gender (male, female), age (continuous), cadre (MD/clinical officer, medical assistant, nurse, HDA/HSA, patient supporter, data clerk/monitor, ART clerk), presence of comorbidities (none, 1, 2 or more). Standard errors clustered by health facility.

^{***}p<0.001.

motivation were strongly associated with the respondent's vaccination status.

Determinants of COVID-19 vaccine motivation

Most respondents expressed confidence in the benefits of the COVID-19 vaccine (Table 3): 74.0% felt that vaccination would save lives (no one said the vaccine would lead to more deaths); and 89.8% agreed that the vaccine would strengthen their immune system (only one person said the vaccine would weaken

their immune system). In models that adjusted for respondent characteristics, agreeing with either of these statements was strongly and significantly associated with positive vaccination motivation, both willingness/eagerness to be vaccinated (adjusted OR [aOR] 9.85, 95% CI 5.50 to 17.62) and encouraging friends and family to be vaccinated (aOR 4.89, 95% CI 2.48 to 9.60). Having confidence in vaccine safety was also significantly associated with motivation (aOR for willingness/eagerness to be vaccinated 4.60, 95% CI 2.92 to 7.23; aOR for encouraging friends and family 23.37, 95% CI 2.94 to 185.51), although

Table 3. Correlates of motivation toward COVID-19 vaccination (n=400)

Construct	Operationalization	n (%) expressing this	aOR willing or eager to be vaccinated (95% CI)	aOR would encourage friends/family to be vaccinated (95% CI)
Confidence in vaccine benefits	If individuals like me get the COVID-19 vaccine it will save a lot of lives (vs save some lives or have no impact)	296 (74.0%)	9.85*** (5.50 to 17.62)	4.89*** (2.48 to 9.60)
	The COVID-19 vaccine will strengthen my immune system (vs will neither strengthen nor weaken, or will weaken)	359 (89.8%)	17.39*** (5.92 to 51.08)	9.61*** (4.79 to 19.26)
Confidence in vaccine safety	Vaccines that are developed quickly will be safe or safety will be unaffected (vs will be unsafe or very unsafe)	159 (39.8%)	4.60*** (2.92 to 7.23)	23.37** (2.94 to 185.51)
	At least some people (vs a few or none) will have significant or life-threatening (vs none or mild/moderate) side effects in the short term	52 (13.0%)	0.49* (0.27 to 0.90)	0.31** (0.15 to 0.66)
	At least some people (vs a few or none) will have significant or life-threatening (vs none or mild/moderate) side effects in the long term	35 (8.8%)	0.39** (0.20 to 0.76)	0.26** (0.10 to 0.67)
Perceived risk	I possibly, probably or definitely will get COVID-19 in the next 12 mo (vs probably not or definitely not)	164 (41.0%)	1.38 (0.88 to 2.16)	1.07 (0.58 to 1.96)
	If I got COVID-19, I would probably end up in hospital, would get quite ill or it would be like a mild flu (vs it would be hardly noticeable or I'd have no symptoms)	253 (63.7%)	1.18 (0.81 to 1.71)	1.08 (0.56 to 2.08)
Seeing negative information	Number of sources of negative information	Median: 4	0.93 (0.84 to 1.02)	0.81** (0.69 to 0.95)
	Percentage of all information sources negative in tone	Median: 35.7%	0.33 (0.11 to 1.06)	0.05** (0.01 to 0.38)

aOR includes: gender (male, female), age (continuous), cadre (physician/clinical officer, medical assistant, nurse, HDA/HSA, patient supporter, data clerk/monitor, ART clerk), presence of comorbidities (none, 1, 2 or more). Standard errors clustered by health facility.

*p<0.05; **p<0.01; ***p<0.001.

most respondents expressed that vaccines developed quickly are unsafe (n=241, 60.3%). A small minority of respondents thought that significant or life-threatening vaccine side effects would be relatively prevalent (short- and long-term side effects thought to affect at least some vaccinated people by 13.0% and 8.8% of respondents, respectively).

Perceived risk of COVID-19 infection was not significantly associated with motivation to receive the vaccine. The 41.0% of respondents who thought it was possible (or likely) that they would be infected with COVID-19 in the next 12 mo were no more likely than those who thought it was unlikely to express willingness/eagerness to be vaccinated (aOR 1.38, 95% CI 0.88 to 2.16) or to encourage their loved ones to be vaccinated (aOR 1.07, 95% CI 0.58 to 1.96). Similarly, people who felt that contracting COVID-19 would result in serious or mild illness (63.7% of respondents) were no more likely to express a positive motivation to receive the vaccine than those who did not feel that a COVID-19 infection would be severe.

Exposure to negative information was common, with participants reporting exposure to a median of four negative sources of information about COVID-19 vaccination, and 35.7% of all information sources about COVID-19 vaccination were negative in tone. Greater exposure to negative information was significantly associated with being less likely to encourage loved ones to be vaccinated (number of negative sources: aOR 0.81, 95% CI 0.69 to 0.95; percentage of all information sources negative in tone: aOR 0.05, 95% CI 0.01 to 0.38), but was not associated with one's own willingness/motivation to be vaccinated (number of negative sources: aOR 0.93, 95% CI 0.84 to 1.02; percentage of all information sources negative in tone: aOR 0.33, 95% CI 0.11 to 1.06).

We assessed respondents' exposure to specific sources of information (Figure 2). The most common sources of negative information were messaging apps (reported by 76.5% of respondents), friends (69.0%), patients (64.8%), social media posts by first-hand contacts such as friends and family (55.0%) and social

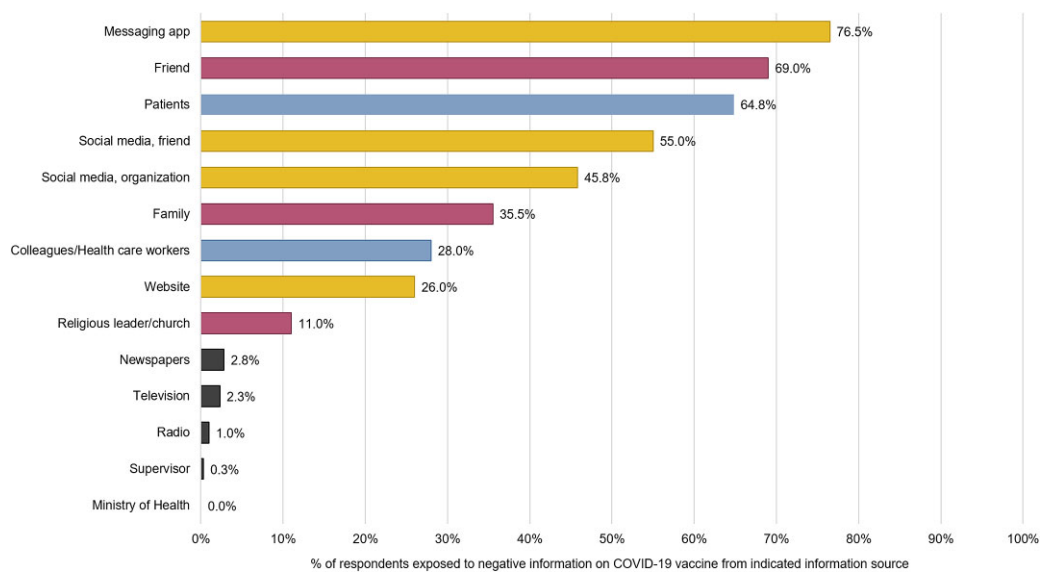


Figure 2. Sources of negative information about the COVID-19 vaccine. The figure shows the % of respondents reporting they heard information that was negative in tone from that source (vs heard no information, or heard information that was positive, neutral or indeterminate in tone). Participants could report multiple sources. Bar colors correspond to categories of information type: yellow: internet/virtual sources; purple: word-of-mouth from friends and family; blue: word-of-mouth at work; black: traditional media.

media posts by others such as companies and organizations (45.8% of respondents).

Discussion

This survey found a high uptake—>80%—of the COVID-19 vaccine among HCWs in Malawi at the time of the national vaccination program launch and following a surge in COVID-19 cases. However, results among HCWs should be generalized with caution (but do match other findings of high vaccine acceptability in low- and middle-income countries¹³), particularly because lay HCWs were less likely to accept the vaccine (just under 80% vs nearly 90% among clinical cadres), so the population-level average may be closer to this value. Similarly, studies from high-income countries have found that lower-cadre workers were more likely to decline the COVID-19 vaccine.^{30,31} How HCWs' acceptance of vaccinations compares with the general public is an important area for future research.

We estimate a substantial difference in likelihood that a respondent had received the COVID-19 vaccine if they expressed a high vs low motivation to be vaccinated. Motivation to be vaccinated was strongly associated with confidence in vaccine benefits and safety, but not with perceived risks of COVID-19 infection or severe disease. This could be due to respondents' attitudes about the AstraZeneca COVID-19 vaccine's efficacy against virus variants predominant in Malawi at the time, as per scientific publications³² and news reports to this effect. This suggests that specific determinants may be particularly important for influencing motivation and, consequently, uptake; emphasizing vaccine safety and general vaccine benefits may be more impactful in this context than communicating the risk of infection.

Many respondents reported hearing negative information about the COVID-19 vaccine from a variety of sources. Social relationships and social media were particularly common sources of negative information about the COVID-19 vaccine. Of particular note, over three-quarters of respondents had encountered negative information via messaging apps. This information about specific social media sources disseminating negative information can guide the targeted placement of factual vaccine information. This is particularly important given the association between exposure to negative information and vaccination motivation, in particular whether the respondent would encourage loved ones to be vaccinated. Interestingly, exposure to negative information was not associated with HCWs' own willingness/motivation to be vaccinated, potentially suggesting that while HCWs' occupation and education may 'insulate' them from the influence of negative information on their own vaccination attitudes, negative information may still shape how they feel about the importance of vaccination for others.

Some limitations of this study should be noted. First, this was a limited population—HCWs in Malawi—so results should be generalized with caution. By including lay cadres, however, we tried to include respondents who better represent the general population. Uptake of the COVID-19 vaccine in this sample was also very high, so further work is needed to understand attitudes and behaviors in different populations. Second, this was a cross-sectional study conducted as the vaccine was being introduced in Malawi and following a COVID-19 surge; attitudes and uptake may change over time as the pandemic continues and roll-out expands. We found no evidence of changing uptake over the study period, but a time trend could emerge over a longer period. This analysis could only examine correlations, and no causal relationships were explored given the cross-sectional study design. Third, we did not analyze the domains of 'social processes' and

'practical issues', both hypothesized to influence vaccine outcomes in the BeSD framework, as all respondents knew someone who had been vaccinated and had been offered the vaccine at their place of work, so there was no variation to explore. Our operationalization of who had declined the vaccine may also have been overly broad, as some eligible, unvaccinated respondents may have encountered logistical or other challenges to vaccination. Lastly, there are very few validated tools on this topic for use in low- and middle-income countries. There may also be social desirability and other biases in reporting vaccination attitudes and behaviors that are important to consider when creating tools for use in diverse settings. Our team tried to mitigate measurement error through careful selection of survey questions, and translation and back-translation of questions with review by multiple bilingual researchers. We encourage further research to develop culturally and contextually appropriate tools to improve the study of vaccine attitudes and behaviors in global contexts.

Conclusions

In this study of HCWs during the early weeks of COVID-19 vaccination in Malawi, a high proportion had accepted the offered vaccine. Vaccine uptake was likely associated with the perceived benefits and safety of the COVID-19 vaccine, and with exposure to negative vaccine information, which was very common in this sample, particularly from loved ones and via social media. Vaccine uptake in low- and middle-income countries, and its determinants, is relatively understudied, so these data offer important new insights about potentially modifiable factors. Future research should more robustly quantify differences across countries and settings, and qualitative research should seek to identify determinants and mechanisms, in order to inform intervention strategies for groups found to be less likely to be vaccinated. With information about what influences vaccine decisions and behaviors, the global health community can design effective implementation strategies and behavioral interventions to ensure high coverage of the COVID-19 vaccine.

Supplementary data

Supplementary data are available at *International Health* online (<http://inthehealth.oxfordjournals.org>).

Authors' contributions: CM, KP, SP and RMH conceived the study; KP, JS, EL and EC led data collection; CM, HSW and JS analyzed the data; CM led the drafting of the manuscript; all authors contributed to the interpretation of results, provided critical revisions to the manuscript, read and approved the final manuscript.

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Competing interests: None declared.

Ethical approval: This study did not involve human patients. Oral consent was obtained from all survey respondents. The study was reviewed and approved by the National Health Sciences Research Committee in Malawi (#2338) and the University of California Los Angeles Institutional Review Board (#21-001278).

Data availability: The data underlying this article cannot be shared publicly for the privacy of individuals that participated in the study. Anonymized survey data are available upon request.

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