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COVID-19 Vaccine Hesitancy in 53 Developing Countries

Levels, Trends, and Reasons for Hesitancy

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Abstract

This paper presents new evidence on the levels and trends of vaccine hesitancy in developing countries based on harmonized high-frequency phone surveys from more than 120,000 respondents in 53 low- and middle-income countries. These countries represent a combined 30 percent of the population of low- and middle-income countries. On average across countries, one in five adults is hesitant about the COVID-19 vaccine, with the most cited reasons for hesitancy being concerns about the safety of the vaccine, followed by concerns about its efficacy. Between late 2020 and the first half of 2021, there tended to be little change in levels of hesitancy except in Iraq, Malawi, and Uzbekistan, where hesitancy increased. COVID-19 vaccine hesitancy is higher among female, young, less educated, and rural respondents, after controlling for selected observable characteristics. Country estimates of vaccine hesitancy from the high-frequency phone surveys are correlated with but lower than those from earlier studies, which often relied on less representative survey samples. The results suggest that vaccine hesitancy in developing countries, while less prevalent than previously thought, will be an important and enduring obstacle to recovery from the pandemic.

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COVID-19 Vaccine Hesitancy in 53 Developing Countries: Levels, Trends, and Reasons for Hesitancy

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1. Introduction

The world is entering the third year of the global COVID-19 pandemic, which has caused enormous devastation to both people's health (450 million cases and 6 million deaths as of March 2022) and national economies, in the form of a global recession that has pushed millions into poverty (Dong, Du and Gardner 2020; World Bank 2022). With the continued emergence of new variants and limited treatments available, it is commonly accepted that widespread vaccination is the world's best bet to contain the virus and it is also expected to play an important role in economic recovery, as widespread vaccinations would enable the reopening of the economy (IMF 2021; Hoogeveen and Lopez-Acevedo 2022).[2] As of early March 2022, over 60 percent of the world's population had received at least one dose of a COVID-19 vaccine. However, there are stark disparities in vaccination rates across countries: only 14 percent of people in low-income countries had received at least one dose as of March 22, 2022, compared to 79 percent in high-income countries and 81 percent in upper-middle income countries (Ritchie et al. 2022) (Figure 1).

The lag in vaccine distribution in lower income countries put the focus mainly on supply-side constraints until recently. However, the latest industry estimates predict that total vaccine production will exceed global demand by mid-2022, more than two years after the start of the pandemic and about a year and half since a COVID-19 vaccine was first authorized for emergency use. In fact, there are multiple reports of a possible "supply glut" and doses going to waste (Sanjay and Bloomberg 2022). Moreover, low- and middle-income countries have also been catching up with high-income countries in terms of the rates of vaccine rollout (Glassman, Kenny and Young, 2022; see also Figure 2). Despite this progress, a significant share of the world's population remains unvaccinated, and if COVID-19 becomes endemic, the necessity of periodic boosters will reinforce the importance of addressing barriers to vaccination both on the supply and demand sides. To this end, it is increasingly important to understand the extent to which individuals in low- and middle-income countries elect to be vaccinated, and if not, to understand the nature of the concerns of those who choose not to. This will help address underlying bottlenecks to achieving immunity among the wider population, especially given the fear that persistent pools of unvaccinated people around the world present a greater risk for the emergence of new SARS-CoV-2 variants (Mallapaty 2022).

[2] Note that lagged increases in vaccination rates for other diseases were also found to be positively associated with increases in GDP growth rates across countries, and increasingly so over time (Masia et al. 2018), but for non-COVID-19 vaccines the primary channel would be that of improved population health, rather than an enabling environment for economic activity.

Figure 1: Vaccination rates by income group

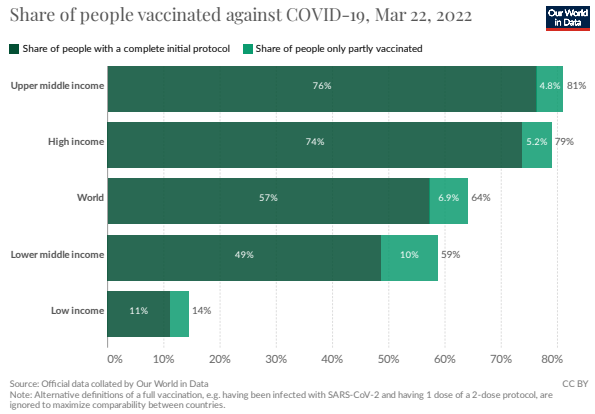
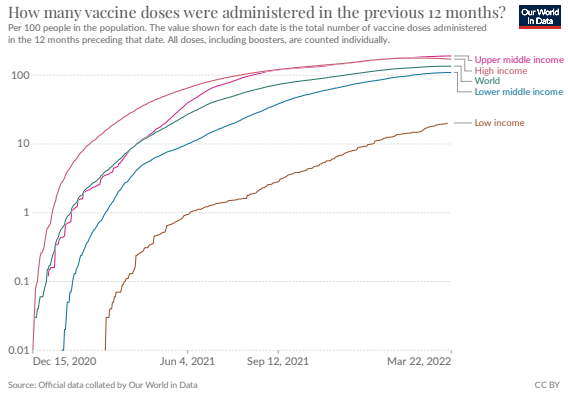


Figure 2: Vaccine rollout rates by income group



Data source: Ritchie et al. 2022 as of March 22, 2022.

Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite availability of vaccination services (MacDonald et al. 2015). It is not a new phenomenon, and some level of hesitancy exists for most vaccines, usually revolving around concerns about efficacy or safety. Even before the COVID-19 pandemic began, the World Health Organization (WHO) identified vaccine hesitancy as one of the top threats to global health (WHO 2019). The 2019 Wellcome Global Monitor from Gallup assessed general attitudes about the importance, safety, and effectiveness of vaccines across the globe prior to the onset of COVID-19. Overall, on average, globally 7 percent of respondents either somewhat or strongly disagreed that vaccines are safe, and 5 percent either strongly or somewhat disagreed that vaccines are effective (Gallup 2019). Levels of vaccine hesitancy were lower in low- and middle-income countries compared with high-income countries. Across regions, countries in Eastern Europe and former Soviet states were among the least likely in the world to believe vaccines are safe and effective. Although these beliefs were expressed prior to the COVID-19 pandemic, they suggest that higher levels of COVID-19 hesitancy might be expected in Central and Eastern Europe as compared to other regions of the developing world. Furthermore, they suggest that concerns about safety are greater than concerns about efficacy.

Despite the importance of vaccinations against COVID-19, little is known about the prevalence of COVID-19 vaccine hesitancy, and even less about the extent to which concerns about the COVID-19 vaccine are similar or different to longstanding concerns about other vaccines. Anecdotally, several factors likely contribute to COVID-19 vaccine hesitancy: for example, the accelerated speed of development of the COVID-19 vaccine, combined with its newness, has intensified concerns about unknown longer-term side-effects. There are also reports of specific effects, such as of myocarditis in men under the age of 40 (Husby et al. 2022). Uncertainty about the duration of the vaccine's effectiveness raises the possibility of needing annual vaccination. The availability of multiple types of vaccination, each with its own levels of efficacy and dosing schedule may also lead to confusion, and hence hesitancy. Relatedly, both the type of vaccine (e.g., mRNA) and country of origin of the vaccine have been identified as a factor in hesitancy. For example, a study from Brazil showed greater rejection among Brazilians for vaccines developed in China and the Russian Federation, as compared to vaccines from the United States or England, which could be related to local politics and foreign policy (Gramacho et al. 2021), as well concerns about data reporting related to vaccine development/approval (Bucci et al. 2021). Wong and colleagues (2021) reported greater hesitancy toward vaccines produced using the mRNA technology in Southeast Asia as compared with Europe and the Americas.

The multi-country studies that exist show relatively high levels of hesitancy to take the COVID-19 vaccine, but many of them focus on high-income countries. A systematic review and meta-analysis of 28 large (>1,000) nationally representative samples in 13 high-income countries collected between March and October 2020 found, across all 13 countries, that 72.9% of the sample intended to vaccinate (95% CI: 66.6% to 78.4%) (Robinson et al. 2021). The study also found that as the pandemic progressed (between March and October 2020), the percentage of people intending to vaccinate decreased and the percentage of people intending to refuse vaccination increased, although intentions varied between samples and countries. Another study of nationally representative surveys from mid-2020 in 19 countries, including 12 high-income countries (HICs), found an average across countries of vaccine acceptance rate across the 12 HICs of 66.6%, with wide variation ranging from 80% in the Republic of Korea to 55% in Russia (Lazarus et al. 2021). Both studies observed that being female, younger, of lower income or education level, and belonging to an ethnic minority group was consistently associated with being less likely to intend to vaccinate.

Less is understood about the levels and reasons of COVID-19 vaccine hesitancy in low- and middle-income countries. A few studies reported multi-country survey results from developing countries (de Figueiredo and Larson, 2021, Facebook 2021, Gallup 2021, Kanyanda et al. 2021, Lazarus et al. 2021, Solis Arce et al. 2021, and Wouters et al. 2021) or systematic reviews of individual country surveys (Sallam 2021), but few of the studies were based on nationally representative samples of respondents or included comparable results for many countries. Taken together, the available literature from low- and middle-income countries suggests that vaccine acceptance is higher in East and South Asia and Latin America and lower in the Middle East and Eastern and Central Asia. Results from Africa were mixed, as were results for different subpopulations. Some studies indicated women were more hesitant than men, younger respondents were more hesitant than older respondents, and those with less education were more hesitant than persons with more education. The predominant reason for hesitancy was concern over side effects from the vaccine. Given the limited availability of randomly selected samples that are representative at the national level, an important contribution of this analysis will be to validate these findings.

This paper extends the existing literature in the following four ways. First and most importantly it provides estimates of vaccine hesitancy for 53 developing countries, which are comparable across countries and largely based on household surveys that are more representative of the national population. In total, these 53 countries represent approximately 30 percent of the population of all low- and middle-income countries and 53.3 percent excluding India and China. Second, it investigates heterogeneity in hesitancy across demographic characteristics of the respondent such as urban or rural residency, gender, age and level of education. Better understanding this heterogeneity can inform the design of vaccination rollouts by helping to target specific population groups. Third, the study expands the evidence base on the reasons behind individuals' reluctance to take the COVID-19 vaccine, even when it is available and free to them. Finally, the analysis enables a comparison between representative and previously published results from less representative sources. Taken together, the paper provides a rich set of results which can aid policy makers in the design of vaccination campaigns in developing countries.

The rest of the paper is structured as follows. Section 2 describes the data and methods, and section 3 provides the results, first for levels and correlates of vaccine hesitancy, followed by changes over time and concluding with reasons reported for being hesitant. Section 4 discusses the results, compares them with the existing literature and suggests some lessons including policy implications.

2. Data and Methods

2a. Data

This analysis describes the levels of vaccine hesitancy and its reasons in 53 developing countries between October 2020 August 2021 using data from the World Bank's COVID-19 high-frequency phone surveys (HFPS) which were implemented to monitor the impact of COVID-19 on households around the world (World Bank 2020). Data are available for one survey round from 39 countries and two or more survey rounds for 14 countries. The countries in the pooled database represent five out of six regions defined by the World Bank: Latin America and the Caribbean (24 countries), Sub-Saharan Africa (14), East Asia and Pacific (7), Europe and Central Asia (6) and the Middle East and North Africa (2).[3] By income group, the sample includes 12 low-income countries, 13 lower-middle income countries, 23 upper middle-income countries and five high-income countries (Appendix Table 1 provides a list of countries with survey month, sample size, region and country income group).

A global core questionnaire served as the basis for each country's survey but was then customized to fit the local context. As a result, the exact questions may vary across countries, but topics typically included knowledge and concerns about COVID-19, access to food, health care and education, employment and income loss, and safety nets and coping strategies. The survey data was then harmonized ex-post to enable cross-country comparability. The questionnaire was flexible and adapted over time to the pandemic context. The vaccine module, for example, was included more recently.

The sampling frame was drawn from pre-existing nationally representative household surveys in 19 countries, random digit dialing (RDD) in 29 countries, and a list of phone numbers typically obtained from mobile phone operators in 5 countries. The RDD design samples from all active mobile and landline phone numbers, such that RDD surveys are representative of the population aged 18 and over with an active phone number, conditional on response and survey completion. Sampling weights were then constructed to correct for selection bias due to the inability to contact households that did not participate in the survey either due to non-response or lack of access to a phone, with the goal of obtaining estimates that are as close to being nationally representative as possible. Information was collected from one respondent per household. In the case of countries where the sampling frame was derived from a previous survey, this was typically the household head. In other cases, such as when the sample utilized RDD, the respondent was more representative of individuals within the household. While the non-random selection of individuals in the former cases is not ideal, in an earlier analysis of labor market indicators derived from phone surveys, Kugler et al. (2021) find little evidence of differences in employment outcomes or trends over time being affected by the oversampling of household heads with respect to variables such as level of education, gender or location, the main source of bias being for age comparisons. Within the pooled data set, the household sampling weights are scaled such that countries are weighted equally, such that estimates of vaccine hesitancy reported in this study are averages of country averages.[4]

2b. Outcome measures

The questions asked about vaccine hesitancy in the surveys varied depending on whether a vaccine was available in the country at the time of the survey. In surveys that took place before the vaccine rollout had

[3] South Asia is not represented due to lack of available data. The Middle East and North Africa includes two countries—Iraq and Lebanon.

[4] Using population weights would have resulted in the results being driven by a small number of large countries.

begun in that country, the question asked was "*If an approved vaccine to prevent COVID-19 was to become available at no cost, would you agree to be vaccinated?*" In surveys that took place after the vaccine rollout had begun, the wording of the question was either "*Are you planning to be vaccinated?*" or "*When a vaccine to prevent COVID-19 is available to you, are you planning to be vaccinated?"* In the sample, 47 countries offered three answer options (yes, not sure, and no), while the other six offered only two categories (yes and no). For this analysis, we combine the "no" and "not sure" answers to obtain the measure of vaccine hesitancy.

To obtain the respondent's reason for vaccine hesitancy, survey respondents who answered "no" or "not sure" were asked "*What is your (main) reason/concern for not wanting to be vaccinated / not being sure if you want to be vaccinated*?" The answer categories varied widely across surveys. To make these more comparable across countries, answers were remapped into the following nine most common categories (see Appendix Tables 2a and 2b for the original answer options in each survey and a mapping of how they were harmonized):

1. Safety, which includes concerns about side effects
2. Efficacy
3. Distrust of government, pharmaceutical industry, international community
4. Dislike of vaccines in general
5. Preference for natural immunity, which included perceiving self as low risk and already having had COVID-19 infection
6. Lack of knowledge or access, which included "I do not have enough information about the vaccine," "too hard to get," "health facility to far" and "I don't have the time"
7. Religious reasons
8. Not eligible, which included "counter-indication," "recent medical discharge, "have an underlying health condition and believe taking the vaccine will make it worse"
9. Other

The surveys also differed across countries in terms of whether a single concern or multiple concerns were collected. To account for the difference in the number of response options, the results are presented separately.

2c. Contextual data

Country-level contextual data were drawn from other sources. New COVID-19 cases per million, measured as a 7-day rolling average prior to the midpoint of the month household survey data was collected in each country, were obtained from Dong and colleagues (2022), and the Oxford Stringency Index was drawn from Hale et al. 2022. The latter is an index, ranging from 0–100, that indicates the degree to which various restrictions were put in place by governments to control the pandemic (for example, school closures and shelter-in-place requirements). Confidence in the press, the government, and the WHO was drawn from the World Values Survey Wave 7, fielded in 2017-2020, and aggregated up to the country level (Inglehart 2022). Excess deaths due to COVID-19 draw on WHO data (WHO 2022). Country geographic region and income group are based on the World Bank classifications.

2d. Analytical strategy

Data from 53 countries was pooled into a single data set. First, we report point estimates and 95% confidence intervals for each country based on standard errors clustered at the state or province level within each country. We also report the simple average across all countries and stratified by: (i) World Bank region, (ii) World Bank country income group, (iii) urban vs. rural residence, (iv) gender of the

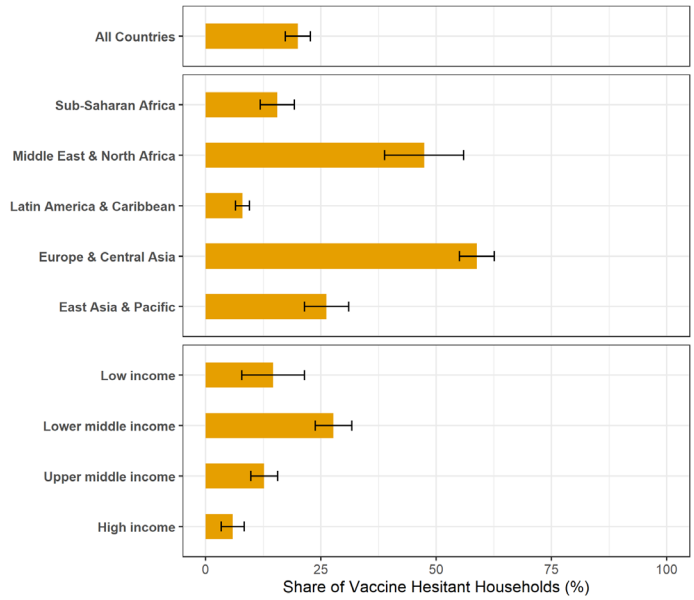
respondent, (v) whether the respondent is head of household, (vi) age of the respondent (under 35 years, 35-64 years, and 65 years and older, and (vii) educational attainment of the respondent (some primary school, some secondary school, some tertiary). Tukey's test of multiple comparisons is used to test the significance of differences in rates of vaccine hesitancy across the above-mentioned groups. Second, we use multivariate regression analysis to assess the relative association of vaccine hesitancy and the correlates and contextual variables. Trends over time in levels of vaccine hesitancy are examined in 14 countries with more than one wave of results available. Finally, the analysis describes the reasons for vaccine hesitancy.

3. Results

3a. Levels of vaccine hesitancy across 53 countries

Overall, when taking a simple average across countries, the average level of vaccine hesitancy across the most recent survey round in each country was 20.0% (Confidence Intervals (CI) 17.2-22.7%). Across regions, average levels of hesitancy were highest in Europe and Central Asia (58.8%, CI 55.0-62.6%), followed by the Middle East and North Africa (47.4%, CI 38.8-56.0%), East Asia and Pacific (26.2%, CI 21.4-31.0%), Sub-Saharan Africa (15.5%, CI 11.8-19.2%), and Latin America and the Caribbean (8.0%, CI 6.5-9.5%) (Figure 3 and Appendix Table 3). Differences between all regions were statistically significant at the 1% level, except for the difference between Europe and Central Asia and Middle East and North Africa (p-value=.017). (See Appendix Table 4 for all results of tests of differences.) When considered by country income group, the highest average level of hesitancy was in lower middle-income countries (27.7%, CI 23.8-31.7%), followed by low-income countries (14.6%, CI 7.8-21.4%), upper middle-income countries (12.7%, CI 9.8-15.6%), and high-income countries (5.9%, CI 3.4-8.4). The level of vaccine hesitancy across country income groups was significant at the 5% level across all pairs with the exception of the comparison between low-income and upper-middle income groups.

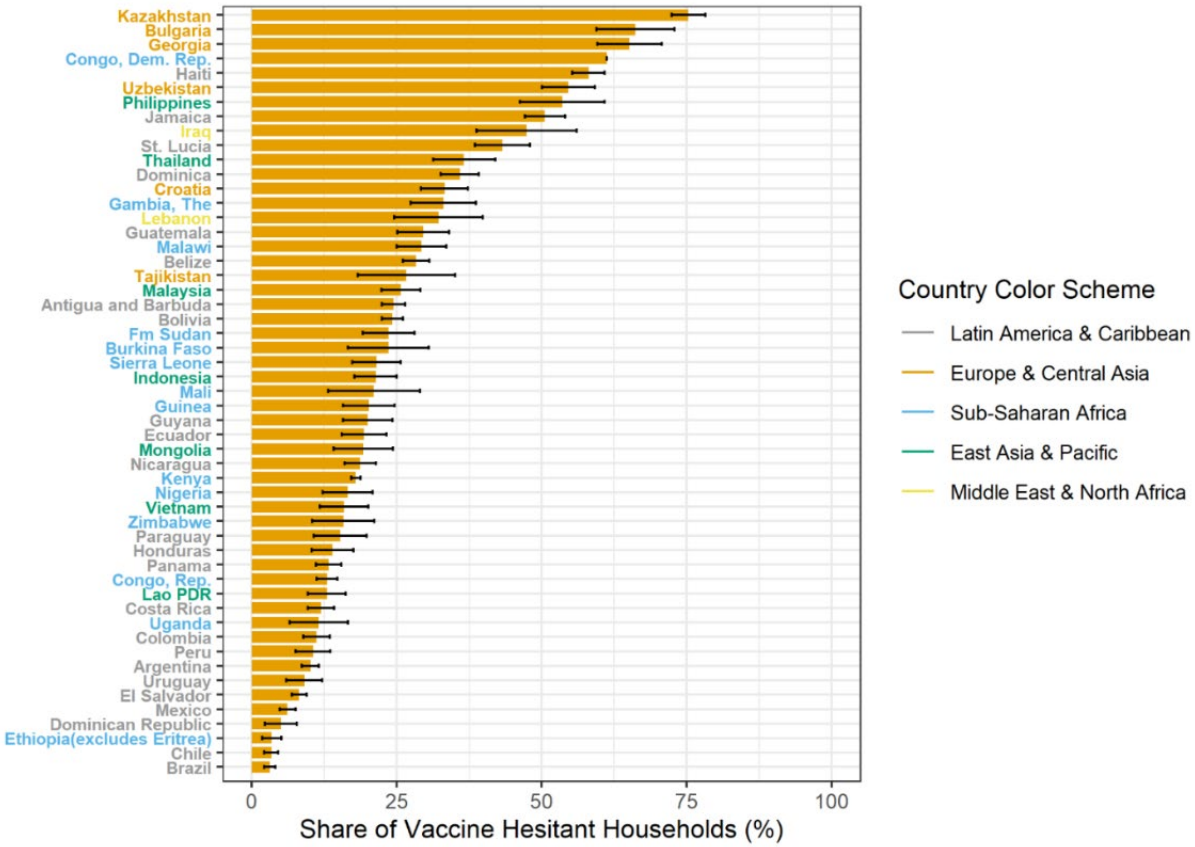
Figure 3: Share of households that were hesitant to be vaccinated against COVID-19 in 53 countries



Note: Weighted estimates, with weights scales such that countries are given equal weights.

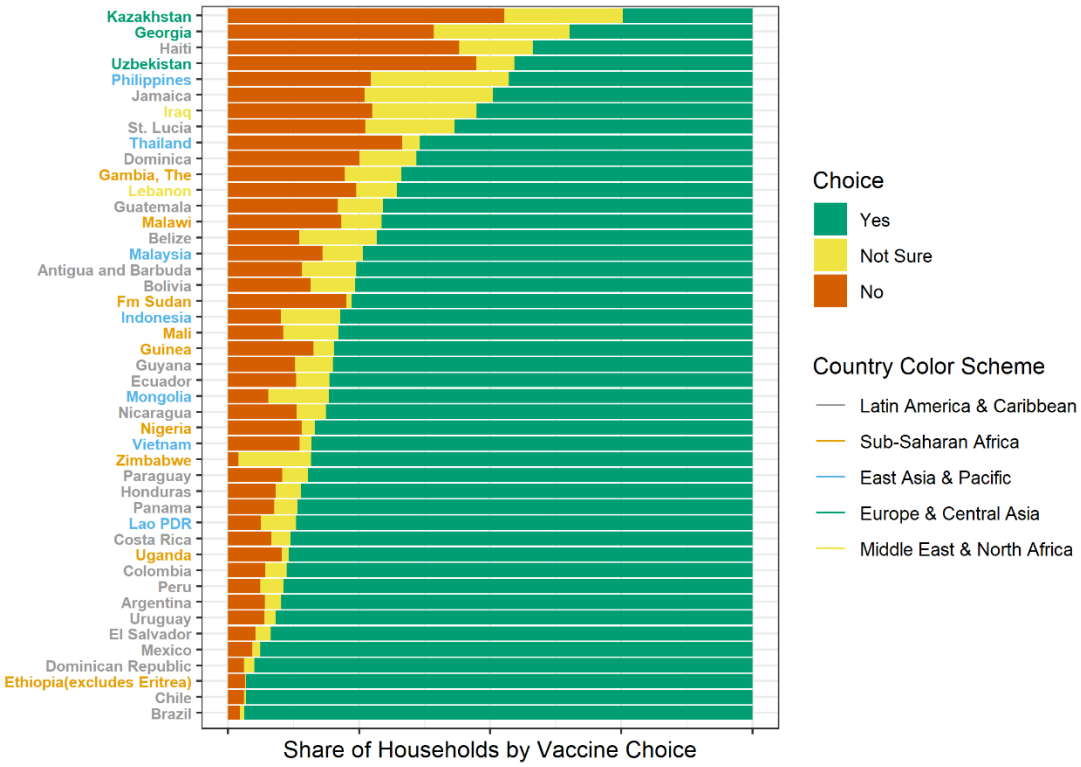
These averages across countries mask the wide range of country-level averages of vaccine hesitancy. The highest levels of vaccine hesitancy were reported in Kazakhstan (75.3%), Bulgaria (66.2%) and Georgia (65.2%), and the lowest levels in Chile (3.4%), Ethiopia (3.4%), and Brazil (3.1%) (Figure 4 and Appendix Table 3). People who are "not sure" about getting vaccinated are likely to be more easily persuaded than those who answer that they would not get vaccinated, and thus there would be more opportunities to increase vaccine uptake in countries with higher shares of respondents who responded "not sure." Figure 5 shows these results for the 46 countries that included all three answer options (yes, not sure, and no). In four countries, over 20% of respondents reported being unsure of whether they would get vaccinated: these countries are the Philippines (26.3%), Georgia (25.9%), Jamaica (24.5%), and Kazakhstan (22.6%). In another 11 countries, between 10% and 20% of the sample was unsure whether they would be willing to be vaccinated against COVID-19: these countries include Iraq, St. Lucia, Belize, Haiti, Zimbabwe, Mongolia, Indonesia, Dominica, The Gambia, Mali, and Antigua and Barbuda.

Figure 4: Share of households that were hesitant to be vaccinated against COVID-19, by country



Notes: Weighted estimates, with weights scales such that 53 countries are given equal weights. Black bars indicate confidence intervals. Point estimates are given in Appendix Table 3.

Figure 5: Strength of sentiment: share of households in 46 countries reporting being "not sure" if they will take the COVID-19 vaccination when available

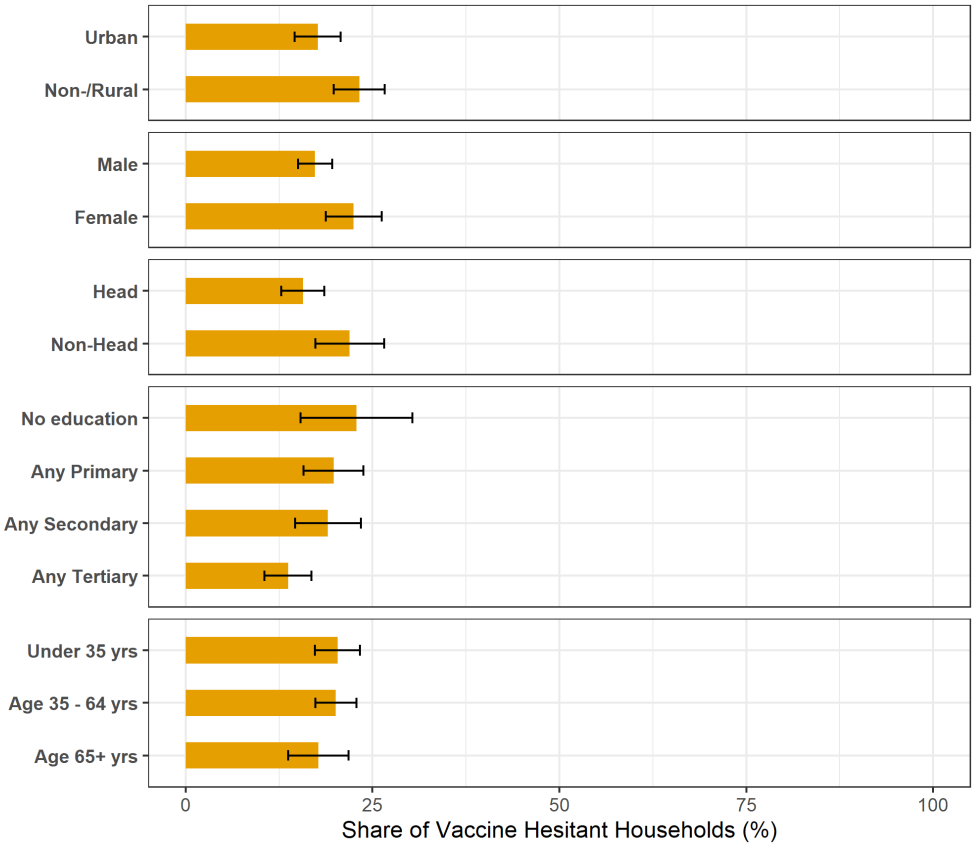


Note: Figure only includes the 46 countries with three response options (yes, not sure, no).

3b. Bivariate correlates of vaccine hesitancy

As expected, the extent of hesitancy varies for different types of respondents. Rural households reported significantly higher levels of vaccine hesitancy than urban households (23.2% vs. 17.7%, p-value=0.018), and female respondents (22.5%) were significantly more likely than male respondents (17.3%) to be vaccine hesitant (p-value=0.021) (Figure 6). Among households in the 33 surveys with information on the educational attainment of the respondent, respondents with lower levels of education had on average higher levels of hesitancy: 22.8% of respondents with no education were hesitant, compared with 19.8% of those with any primary education, 19.0% of respondents with any secondary education, and 13.7% of those with some tertiary education. Only the rates of hesitancy of those with at least some tertiary education were significantly lower than those with no education (p-value=0.027), some primary (p-value=0.019), and some secondary (p-value=0.052). Younger respondents reported higher levels of hesitancy than older respondents: 20.3% of respondents under 35 years of age were hesitant to get vaccinated, 20.1% of respondents aged 35-59 years, and 17.7% of those over the age of 60 years. None of the differences in age were statistically different from each other in bi-variate tests.

Figure 6: Share of households that were hesitant to be vaccinated against COVID-19 in 53 countries, by individual characteristics



Notes: Weighted estimates, with weights scales such that 53 countries are given equal weights, except for results by education which include only results from the 33 country surveys with information on the educational attainment of the respondent.

3c. Multivariate analysis of correlates of vaccine hesitancy

Results from a multivariate regression generally confirm the bivariate results. Results from OLS regression models are shown in Table 1: a baseline model with the correlates described above plus month of survey (expressed in terciles),[5] and extended models with additional contextual variables (expressed in terciles). Results from these models are consistent, as are the marginal effects from logit regressions (see Appendix Table 5a). Men are less COVID-19 vaccine hesitant than women, although the magnitude is small. Having less formal education is associated with being more hesitant and the differences are more substantial. Respondents with no formal education are 12.3 percentage points more likely to be hesitant than respondents with some tertiary education. Those with some primary or some secondary education are 6.1 and 6.4 percentage points more likely, respectively. Age is inversely correlated with hesitancy – adults over 65 years of age are 10.3 percentage points less likely to be hesitant compared with respondents under the age of 35 years, and respondents aged 35-64 years are 4.7 percentage points less likely. There are no statistically significant differences between hesitancy among rural and urban respondents.

[5] Time of survey was split into the following 3 groups: (i) November 2020 – January 2021; (ii) March – May 2021; and (iii) June – August 2021. There are no observations in the data for February and April of 2021.

Differences across regions were statistically significant and, for some regions, quite large: those living in Europe and Central Asia are 36.3 percentage points more likely to be hesitant than those living in the reference region of Latin America and the Caribbean, those in the Middle East and North Africa are 23.1 percentage points more likely and those in East Asia and the Pacific, 21.1 percentage points more likely. Differences between Sub-Saharan Africa and Latin America and the Caribbean were not statistically significant, nor were differences by country income group. Over time, the probability of being hesitant to take the COVID-19 vaccine declined but not significantly.

Table 1: Multivariate analysis of vaccine hesitancy in 53 developing countries

Dep. Var: Hesitancy	(1)	(2)	(3)	(4)	(5)	(6)
Male	-0.028*	-0.027*	-0.028	-0.027*	-0.031*	-0.038**
	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.012)
Head of HH	0.012	0.009	0.019	0.000	0.011	0.007
	(0.015)	(0.014)	(0.013)	(0.017)	(0.015)	(0.013)
Education of respondent (ref – Tertiary)						
No education	0.123***	0.125***	0.116***	0.134***	0.125**	0.143***
	(0.033)	(0.035)	(0.032)	(0.037)	(0.040)	(0.036)
Any primary	0.061**	0.063**	0.060**	0.067**	0.052*	0.070**
	(0.018)	(0.019)	(0.018)	(0.019)	(0.020)	(0.021)
Any secondary	0.064***	0.065***	0.062***	0.065***	0.058***	0.062***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Age group (ref. -- 34 and younger)						
Working age (35-64)	-0.047**	-0.048***	-0.042**	-0.050***	-0.045**	-0.049***
	(0.014)	(0.013)	(0.015)	(0.013)	(0.015)	(0.012)
Retirement age (65+)	-0.103***	-0.102***	-0.096***	-0.103***	-0.099***	-0.099***
	(0.023)	(0.024)	(0.023)	(0.022)	(0.024)	(0.023)
Rural area	0.016	0.014	0.013	0.010	0.012	0.011
	(0.019)	(0.018)	(0.018)	(0.015)	(0.015)	(0.011)
Region (ref – LAC)						
EAP	0.211**	0.218*	0.241**	0.127	0.299	0.249
	(0.076)	(0.086)	(0.084)	(0.076)	(0.155)	(0.137)
ECA	0.363***	0.364***	0.347***	0.376***	0.369***	0.345***
	(0.075)	(0.076)	(0.073)	(0.076)	(0.056)	(0.068)
MNA	0.231***	0.230***	0.262***	0.240***	0.288***	0.393***
	(0.043)	(0.043)	(0.062)	(0.036)	(0.059)	(0.050)
SSA	0.082	0.089	0.078	-0.005	0.072	0.057
	(0.075)	(0.079)	(0.074)	(0.101)	(0.086)	(0.103)
Income group (ref. – LIC)						
LMIC	-0.073	-0.071	-0.052	-0.090	-0.049	-0.053
	(0.127)	(0.124)	(0.122)	(0.129)	(0.113)	(0.081)
UMIC	-0.052	-0.050	-0.071	-0.096	-0.026	-0.130
	(0.154)	(0.154)	(0.146)	(0.154)	(0.135)	(0.107)
HIC	-0.161	-0.160	-0.183	-0.208	-0.175	-0.280*
	(0.159)	(0.162)	(0.153)	(0.162)	(0.136)	(0.108)
Survey month (ref -- Nov 2020 - Jan 2021)						
March - May 2021	-0.073	-0.062	-0.102	-0.056	-0.113	-0.110
	(0.095)	(0.108)	(0.104)	(0.101)	(0.112)	(0.095)
June - August 2021	-0.018	-0.012	-0.018	-0.028	-0.049	-0.026
	(0.090)	(0.099)	(0.099)	(0.089)	(0.097)	(0.079)
New COVID-19 cases per million, terciles						
		-0.022				0.023
Cases (middle tercile)		(0.065)				(0.057)
		-0.009				-0.011
Cases (top tercile)		(0.054)				(0.049)

Dep. Var: Hesitancy	(1)	(2)	(3)	(4)	(5)	(6)
Oxford stringency index terciles (ref. – bottom tercile)						
Stringency (middle tercile)			0.061			0.148
			(0.073)			(0.077)
Stringency (top tercile)			-0.005			0.028
			(0.060)			(0.059)
WHO excess deaths due to COVID-19 (ref.- bottom tercile)						
Excess deaths (middle tercile)				-0.110*		-0.123
				(0.050)		(0.080)
Excess deaths (top tercile)				-0.059		0.045
				(0.067)		(0.106)
Confidence in government index tercile (ref.- top tercile)						
Confidence in government					0.073	0.105
					(0.054)	(0.064)
Confidence in government (top					0.016	0.055
					(0.131)	(0.135)
Constant	0.282*	0.286*	0.265	0.395**	0.206	0.190
	(0.136)	(0.140)	(0.141)	(0.143)	(0.149)	(0.145)
R-squared	0.090	0.090	0.095	0.097	0.102	0.123
N	65088	65088	65088	65088	65088	65088

Notes: Weighted logit regressions. Marginal effects reported. Standard errors clustered at country level. *, **, *** indicates significance at the 95%, 99%, and 99.9% level.

In the extended regression model, we test two additional hypotheses. First, we expect that the severity of the pandemic, for which we use three different proxies, would be negatively correlated with hesitancy. Our first measure, in column (2) is the number of new cases of COVID-19 reported in the country. The higher the risk of infection and illness, as captured by the number of new cases, may make respondents more inclined to get vaccinated to protect against COVID-19 infections. At the same time, it should be recognized that testing capacity differed significantly across countries and over time, such that the measures of new COVID-19 cases per million is an imperfect proxy for pandemic severity. Nevertheless, this variable also captures the visibility of the pandemic to the overall population (even if true severity may be higher), and we would expect visibility / salience to be negatively correlated with hesitancy as well.

Our second proxy for pandemic severity, in column (3), is the degree of stringency in the government's policy measures, as captured by the Oxford policy stringency index. We expect ex-ante that a more stringent the policy response, signaling higher severity of the pandemic and more restrictions on movement, would be positively associated with willingness to be vaccinated.

Our third proxy for pandemic severity, in column (4), is the number of excess deaths associated with the COVID-19 pandemic, as reported by the WHO. The excess mortality measure quantifies the direct and indirect impacts of COVID-19, measured in terms of the difference between the total number of deaths for a specific place and time period and the number of deaths that would have been expected in the absence of COVID-19. This difference is inclusive of both deaths directly attributable to COVID-19 as well as deaths indirectly associated with COVID-19 through its impact on health systems and society. As a prior, we would expect higher levels of excess COVID-19 deaths to be positively correlated with willingness to get vaccinated, although, at the same time, higher hesitancy can also bring about more excess deaths.

In our data, none of the three proxies for pandemic severity and/or visibility is statistically associated with vaccine hesitancy with the exception of COVID-19 excess deaths, where in countries in the second tercile of the excess deaths distribution vaccine hesitancy is, on average, lower, relative to the bottom tercile baseline.

We also test whether trust in the government in general is associated with COVID-19 vaccine hesitancy, expecting a positive association due to widespread reporting of misinformation and antivax messages reported in the press, especially online. However, this association is not statistically significant in the regression model.

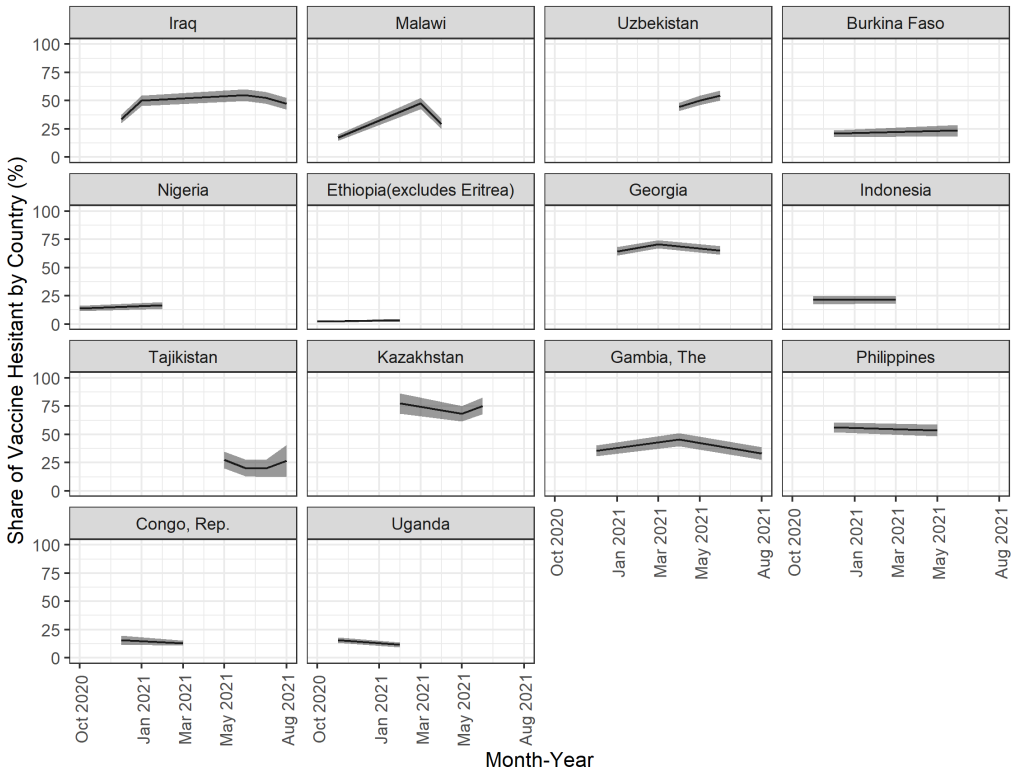
Finally, we also disaggregate the vaccine hesitant population into those who say that they would not get a COVID-19 vaccine and those who are not sure (see Figure 5) and consider whether the underlying characteristics of these two subgroups differ. In order to do so, we consider vaccine hesitancy as being a spectrum that spans from a rejection of the vaccine to the acceptance of the vaccine, with uncertainty being an intermediate category. This allows us to model the vaccine decision as an ordinal model, keeping the extended specification from table 1 (see Table 5b in the Appendix). When we examine the correlates of the "No" and the "Not sure" groups separately, we observe similar patterns, but they are much weaker in terms of magnitudes for the "Not sure" group. For instance, lower levels of education are associated with a higher probability of answering No, and this is true for the Not sure group, but the magnitude of the marginal effects is much smaller for the latter. Likewise, the probability of answering "Not sure" is also higher among the working age and older population, relative to those under the age of 35, but the strength of these negative correlations is considerably smaller. The ECA, MNA and EAP regions have a higher probability of both No and Not sure answers relative to the LAC region baseline.

3d. Changes in vaccine hesitancy over time

Estimates of vaccine hesitancy were available for two or more survey rounds in 14 countries in the sample. Seven countries had estimates from two survey rounds (Burkina Faso, Republic of Congo, Ethiopia, Indonesia, Nigeria, Philippines, and Uganda) and seven countries (The Gambia, Georgia, Iraq, Kazakhstan, Malawi, Tajikistan, and Uzbekistan) had results from three or more survey rounds. All surveys were collected between October 2020 and August 2021, although the specific months of data collection varied across countries.

There are no clear patterns in terms of the changes in vaccine hesitancy in countries with multiple data points over the pandemic. Among the 14 countries with two or more surveys (collected between October 2020 and August 2021), the rates of COVID-19 vaccine hesitancy declined in half of the countries and increased in the other half, and changes in either direction were less than five percentage points in all but three countries (Figure 5 and see Appendix Table 6 for point estimates and confidence intervals). However, larger increases were observed in Iraq (30% increase), Malawi (36% increase), and Uzbekistan (18% increase). No patterns of change over time were observed across sub-populations either. It should be noted, however, that the period for which multiple rounds of the phone surveys are available is relatively short, and during this time very few countries experienced substantial increases in vaccination rates, such that individuals would have few in-person experiences from which to model behavior.

Figure 7: Changes in levels of vaccine hesitancy in 14 countries, October 2020 to April 2021



Notes: The shaded area around the line represents the confidence bands.

3e. Reasons for COVID-19 vaccine hesitancy

Survey respondents in 45 countries who answered "no" or "not sure" about being vaccinated were asked the reason for their hesitancy. The countries include 23 in Latin America and the Caribbean, 14 in Sub-Saharan Africa, five in East Asia and the Pacific, two in the Middle East and North Africa (Djibouti and Lebanon), and one in Eastern Europe and Central Asia (Georgia). In the Republic of Congo, results on reasons for hesitancy were reported for two survey waves (December 2021 and March 2022). In 38 countries, the question solicited a single reason, whereas in seven countries the survey instrument allowed for multiple responses.

Overall, the most common concern pertained to the safety of the vaccine, including concerns about side effects. This was true regardless of the number of responses collected. Figures 8a and 8b show the distribution of responses for countries with single and multiple response options, respectively. Among the 42 countries with the single answer option, an average of 43% of respondents cited safety concerns as the primary reason for not planning to be vaccinated, with a range from 15.4% in Somalia to 84.6% in the Philippines. Other commonly cited concerns included efficacy of the vaccine (19%), dislike of vaccines in general (9%), a preference for natural immunity (which includes perceiving self as low risk and already having had COVID-19 illness) (8%), lack of knowledge about or access to the vaccine (6%), lack of trust in the government/pharmaceutical industry/international community (5%), religious reasons (4%), perceiving oneself as not eligible (which includes counterindication) (4%) and other reasons, which included concerns about getting COVID-19 at the facility and other unspecified reasons (9%). These

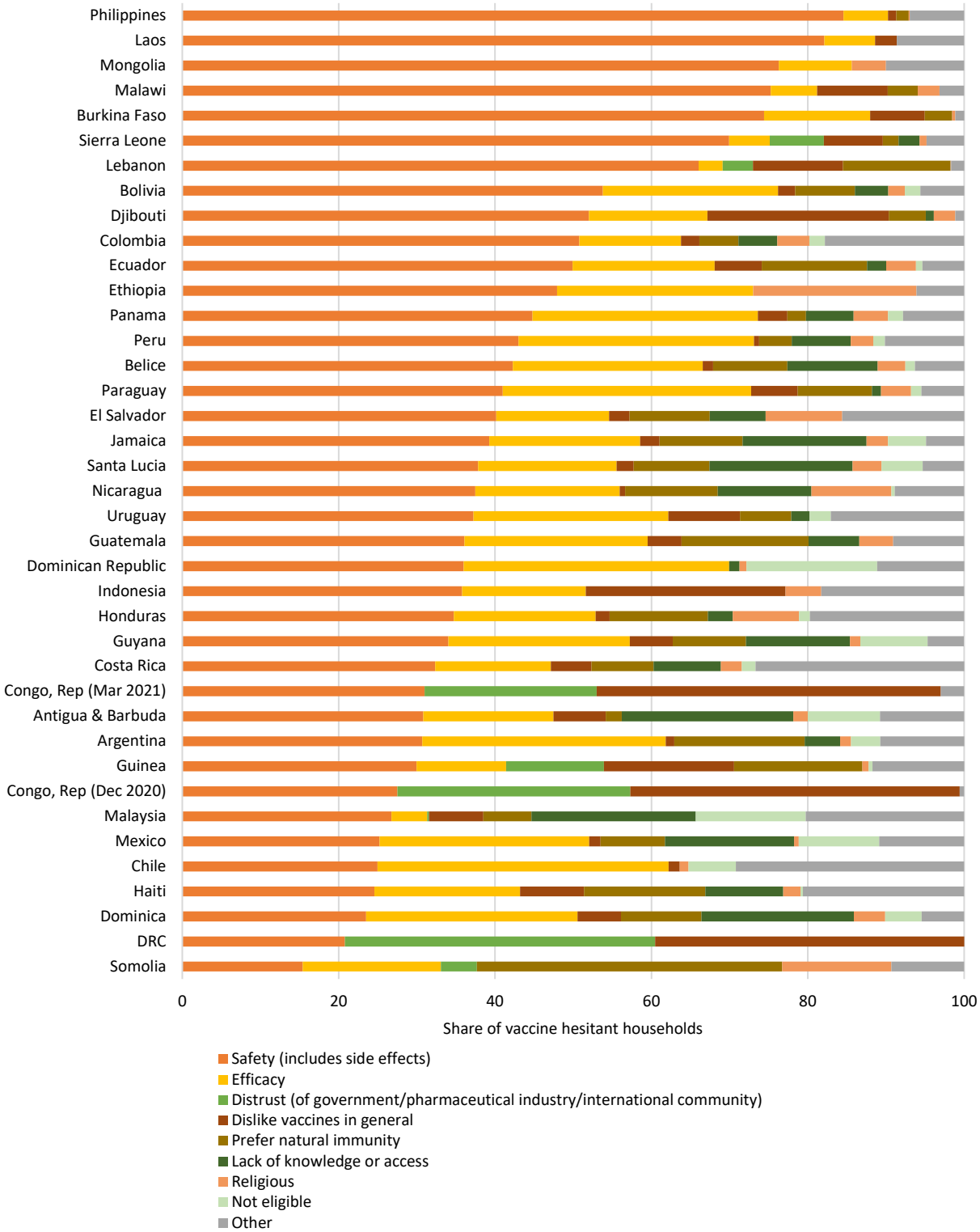
averages mask significant variation across countries. Concerns about vaccine efficacy were greater or equal to concerns about safety in five Latin American countries (Argentina, Chile, Dominica, Dominican Republic, and Mexico). Respondents in the Democratic Republic of Congo and the Republic of Congo were hesitant because of dislike for vaccines in general (40% and 44% in March 2021 of hesitant respondents, respectively) and distrust for government, pharmaceutical industry, and the international community (40% and 22% in March 2021, respectively).

Supply-side concerns for not getting vaccinated such as "health facility too far or too hard to get to," "there is shortage of vaccines in the country," and "I don't know how to access the vaccine" (see Appendix Table 2b for full list) only accounted for 6% on average across all surveys with the single answer option. However, over 10% of respondents in several Latin American countries reported the concerns "Health center too far or hard to reach" or "I don't have time to go to get vaccinated." These included Antigua and Barbuda (22%), St. Lucia (18%), Jamaica (16%), Guyana (13%), Belize and Nicaragua (both 12%). The relatively incidence of supply-side concerns in the HFPS data may be influenced by the framing of the question, however, such as the access issues being queried in the context of other concerns, or because respondents were asked if they would get vaccinated "when the vaccine becomes available", and access constraints may be equated in people's minds with vaccines not being available presently, and thus vaccines becoming available signifying the alleviation of existing supply constraints. We are not able to test this formally, however.

Among the seven countries with multiple answer options, a similar pattern was observed: concerns about safety were the most common concern cited in five countries (Mali, Nigeria, Kenya, Sudan, Uganda). In The Gambia, dislike of vaccines in general was the most cited reason, followed by preference for natural immunity (which includes perceiving self as low risk and already having had COVID-19 illness). In Georgia, the only country in Europe and Central Asia with information on reasons for hesitancy, the most cited reason was "not eligible," followed by lack of knowledge or access and preference for natural immunity.

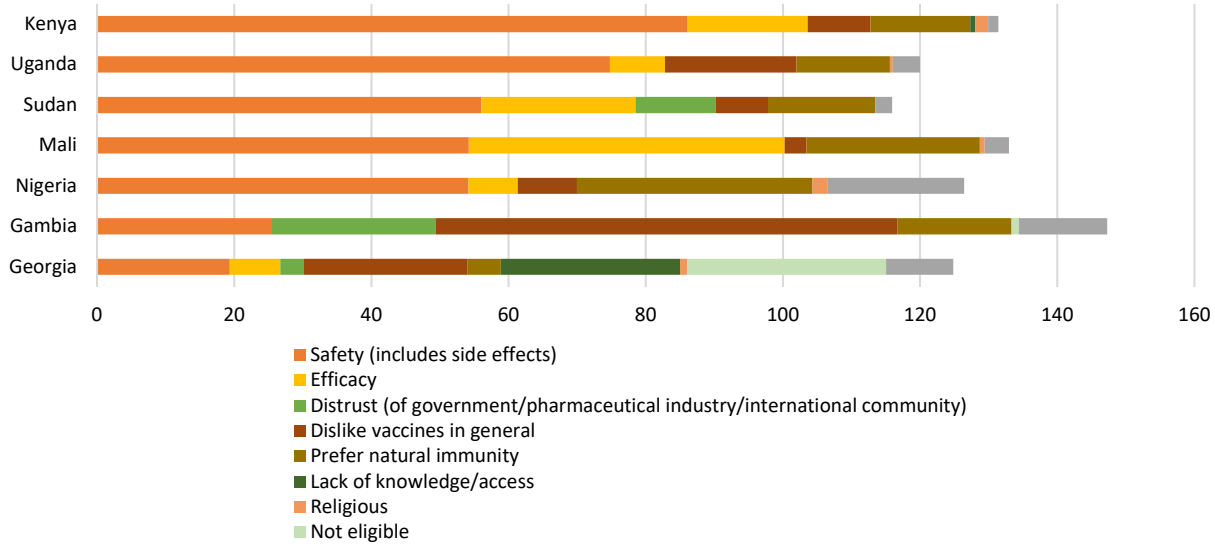
Only one country, the Republic of Congo, reported reasons for two waves. Between December 2020 and March 2021, only small changes in reasons were seen: the share of respondents who cited distrust of the international community declined from 30% to 22%, and the share who cited concerns about safety and dislike of vaccines in general increased (from 27% to 31% and 42 to 44%, respectively).

Figure 8a: Reason for vaccine hesitancy, countries with single response



Note: For the construction of harmonized response categories, see Appendix Table 2b.

Figure 8b: Reason for vaccine hesitancy, countries with multiple responses



Notes: The X axis represents share of vaccine hesitant households. In some cases, the share is larger than 100% because multiple responses were allowed For the construction of harmonized response categories, see Appendix Table 2b.

4. Discussion

4a. Principal findings

Data from the HFPS were used to investigate COVID-19 vaccine hesitancy. On average across 53 countries, one in five adults are hesitant about getting a COVID-19 vaccine. The highest levels were observed in Eastern European and Central Asian countries and the lowest levels in Latin American and Caribbean countries. Among population groups, female respondents, younger adults, and those with less formal education reported higher levels of COVID-19 vaccine hesitancy than their respective counterparts. Between October 2020 and August 2021, there tended to be little change in levels of hesitancy except in Iraq, Malawi, and Uzbekistan, where hesitancy increased. The main self-reported reason for being hesitant was concerns over safety, especially worries about side effects, and to a lesser extent, concerns over vaccine efficacy and dislike of vaccines in general.

4b. Strengths and comparisons with other studies

This study has several advantages over the existing literature. It is based on a very large sample of respondents from national surveys in 53 developing countries, a part of the world that is under-represented in the literature. Over half of the surveys used random digit dialing, typically in upper middle-income countries in which a large share of the population uses mobile phones. In lower income contexts, most surveys, 35 percent overall, sampled based on previous face-to-face surveys which were in turn drawn from a census frame. In the remaining 10 percent of cases, sampling was carried out from lists provided by mobile phone operators. In each case, surveys drawn from pre-existing face-to-face surveys were reweighted using the baseline data to become more representative, while many random digit dialing surveys were also reweighted to make those samples more representative of the universe of phone numbers. While it is impossible to eliminate issues of representativeness in phone surveys, the high-

frequency phone surveys were typically carried out by National Statistics Offices and are more plausibly representative than convenience web surveys.

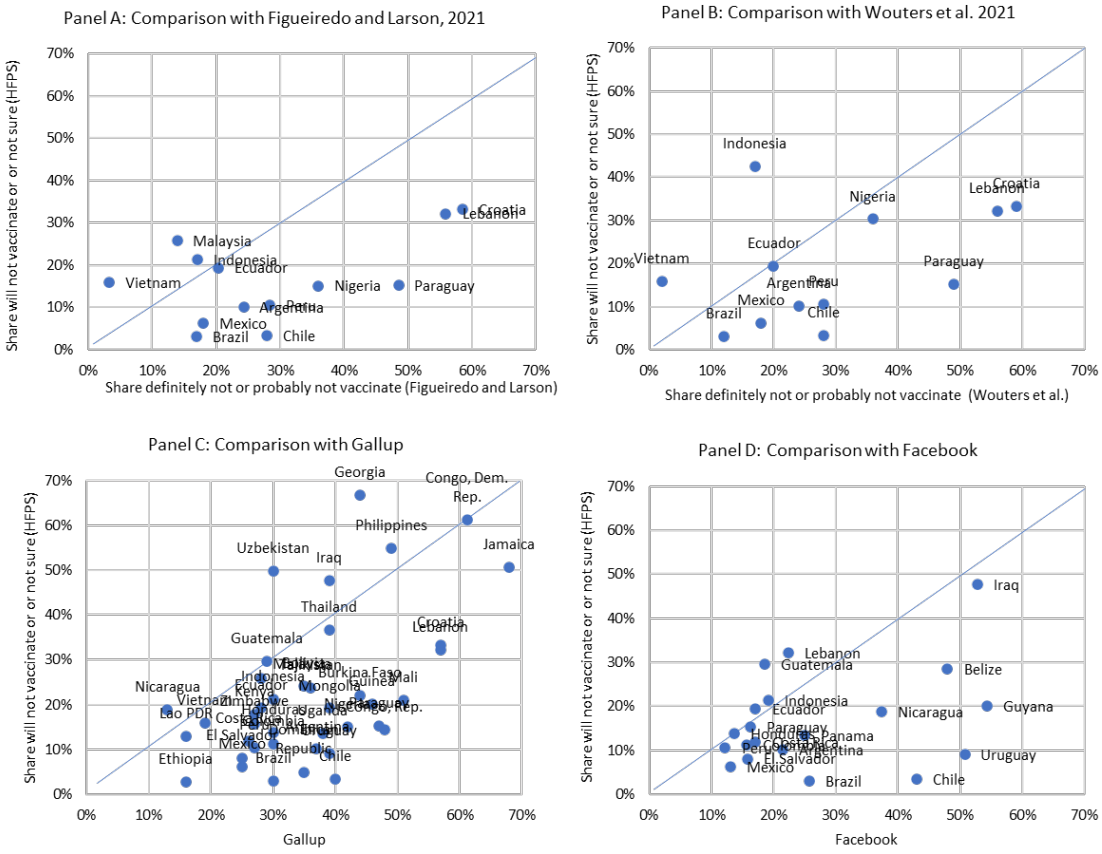
Overall, the estimates of COVID-19 vaccine hesitancy from the HFPSs were more conservative than other published estimates (Figures 9 and 10). There are various possible explanations for the differences. The first relates to the timing of data collection. Most of the existing literature is based on surveys carried out in mid to late 2020 (e.g., de Figueiredo and Larson 2021, Gallup 2021, Lazarus et al. 2021, Solis Arce et al. 2021, and Wouters et. A. 2021), whereas the HFPS data included in our sample were collected from end-2020 through August 2021. It is plausible to believe COVID-19 vaccine hesitancy generally declined during this period as multiple vaccines became available and widespread vaccination was safely rolled out in high-income countries.

Another possible reason for the differences is the variation in how the vaccine hesitancy question was framed and the response options available. For example, the HFPS question in countries without general access to the vaccine at the time of data collection was "When a vaccine to protect you from COVID-19 is available to you, are you planning to be vaccinated?" whereas other studies included the phase "at no cost to you" or descriptors about the quality of the vaccine such as "COVID-19 vaccine proven safe and effective") (Gallup 2021, Lazarus et al. 2021). There was even more variation across the studies in the answer options available to the respondents. One study relied on a 5-point Likert scale of agreement with the statement "If a COVID-19 vaccine is proven safe and effective and is available, I will take it": 'completely disagree', 'somewhat disagree', 'neutral/no opinion', 'somewhat agree' and 'completely agree" (Lazarus 2021). Others relied on a 4-point Likert scale to the question such as "yes, definitely," "yes, probably,' "no, probably not," and "no, definitely not" (Africa CDC, Facebook 2021, de Figueiredo and Larson 2021, Wouters et al. 2021), whereas the HFPS mostly relied on three answer options (yes, not sure, no). It is possible that "probably not" is not the same as "unsure," although it is not known how this might bias the respondents' answers and cross-study comparisons.

Finally, variations in survey modality may have created biases. Among the published studies included for comparison, many studies were based on data from commercial online sample providers, often using quotas sampling to ensure an appropriate distribution in terms of gender, age, and region (Africa CDC, de Figueiredo and Larson, 2021, Facebook 2021, Gallup 2021, Lazarus et al. 2021, and Wouters et. A. 2021), while others were based on convenience samples (Anjorin et al. 2021, Asadi Faezi et al 2021, Bono 2021, Wong 2021), or a mix of methods (Solis-Arce et al. 2021 and Sallam 2021). There was also wide variety in the survey mode, including online, computer-assisted telephone, and face-to-face surveys.

It is not possible to know the extent to which each of the above-mentioned potential sources of bias affect the comparisons of the findings from the HFPS with the others. For example, it was possible to match the Facebook survey results for the month and year of the HFPS for 20 countries, thus taking away any differences in the timing of the survey. Nevertheless, the HFPS estimates were still lower than those reported by Facebook (Figure 9, Panel D), and this could be due to differences in question-and-answer wording and/or the sample frame.

Figure 9: Comparison of share of population COVID-19 that is hesitant to take the COVID-19 vaccine, HFPS with other studies

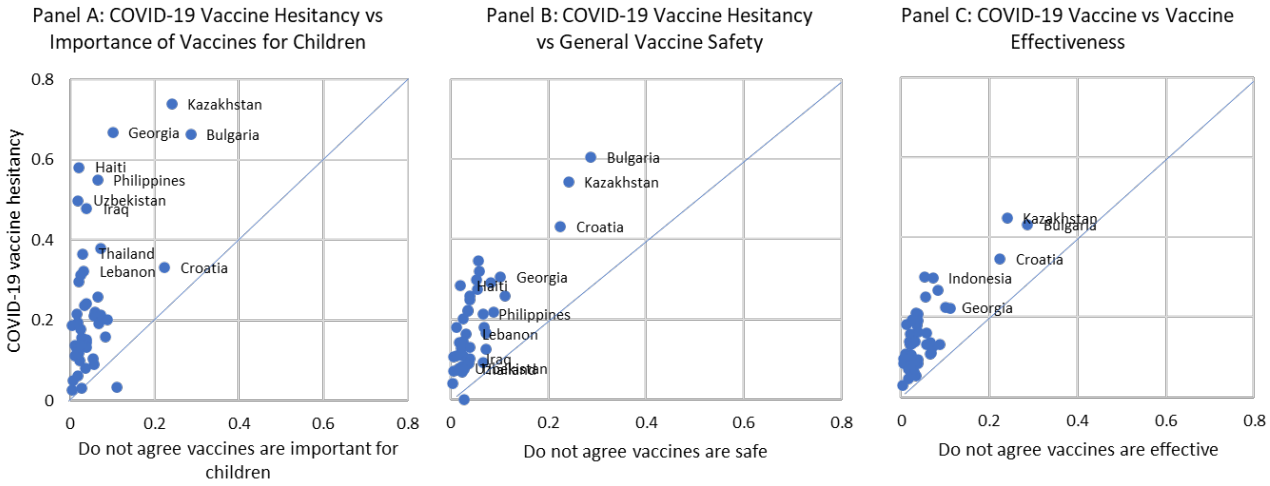


Notes: The y-axes indicate the share of the sample who reported not being willing or not sure if they will take the COVID-19 vaccine, as reported in the HFPS. The x-axes indicate the share of households in the survey that will definitely or probably not be vaccinated against COVID-19 from the following sources. Panel A: Figueiredo and Larson (2021). Panel B: Wouters et al. (2021). Panel C: Gallup (2021). Panel D: Facebook (2021).

Even though the HFPS estimates are lower than other sources, the levels of COVID-19 vaccine hesitancy reported here are nonetheless higher than the levels of vaccine hesitancy reported for other vaccines. We compared the average country levels of COVID-19 vaccine hesitancy from this study with results from 2019 Global Monitor for 45 countries with observations in both studies. Overall, the levels of COVID-19 vaccine hesitancy reported here are higher than disagreement about the importance of vaccines for children (Figure 10, Panel A), concerns about the safety of vaccines (Figure 10, Panel B) and concerns about the efficacy of vaccines (Figure 10, Panel C). However, there are also similarities in the pattern: countries in Europe and Central Asia and some Sub-Sahara African countries reported the highest levels of vaccine hesitancy even before the pandemic, and the biggest reason for pre-COVID-19 vaccine hesitancy was around safety concerns; both findings are consistent with the COVID-19 vaccine hesitancy results derived from the HFPSs. Nevertheless, the higher levels of hesitancy reported for the COVID-19 vaccine suggest that respondents are more concerned about the COVID-19 vaccine than about childhood vaccines. The result is even more striking considering that the COVID-19 vaccine hesitancy is estimated rather conservatively in the HFPS, when compared against estimates from other sources. For example, a comparison between the Gallup (2021) estimates of COVID-19 vaccine hesitancy with 2019 Global Monitor estimates of general vaccine hesitancy (also collected by Gallup) for 38 countries included in this study showed that 34.7% of respondents on average across countries were

hesitant to be vaccinated against COVID-19, whereas from the Global Monitor only 4.4% did not agree vaccines were important for children, 17.2% did not agree vaccines are safe, and 15.2% did not agree they are effective. Possible reasons for the higher rates of COVID-19 vaccine hesitancy include that it is a very new vaccine that uses an innovative technology (mRNA), it was rapidly developed with a streamlined approval process, and may have unknown long-term effects. This is consistent with the reasons given by respondents, which are mostly around safety, and to a lesser extent efficacy.

Figure 10: Comparison of COVID-19 Vaccine Hesitancy with pre-COVID sentiment about vaccines from 2019 Global Monitor, 45 countries



Notes: The y-axes indicate the share of the sample who report either not willing or not sure if they will vaccinate, as reported in the HFPS. The x-axes indicate the share of the 2019 Global Monitor Report sample that reported they do not agree vaccines are important for children (Panel A), do not agree that vaccines are safe (Panel B), and do not agree vaccines are effective.

Our findings that women, younger adults, and those with less education are more vaccine hesitant are largely consistent with results presented elsewhere. De Figueiredo and Larson (2021) and Solis Arce et al. (2021) reported that women were more vaccine hesitant than men. While Lazarus and colleagues found that men were slightly more hesitant than women, the gender difference was small. The findings with respect to age were also similar—the youngest adults were significantly less willing to be vaccinated than adults over 65 years of age (Lazarus et al. 2021, de Figuereido and Larson 2021). The low levels of vaccine hesitancy reported among the oldest adults provides an important opportunity for vaccine campaigns to target this demographic, especially given recent research that targeting vaccines to older age groups saves the most lives and is highly cost-effective (Cheikh, Spitz and Wilson 2022, Orangi et al. 2022). The findings on education are also consistent with other studies (Lazarus et al. 2021 and de Figueiredo and Larson 2021), although Solis-Arce and colleagues (2021) reported mixed results. Knowing that citizens who are younger and with less formal education are the most likely to be vaccine hesitant can help vaccination campaigns target these population groups.

Although we hypothesized that confidence in the government in general would be negatively associated with vaccine hesitancy, this association was not statistically significant in the regression analysis. This is largely because trust indicators are only available at the national level, making the estimates imprecise, but it is also consistent with other studies. Kanyanda and colleagues (2021) considered a measure of trust in the government's management of the COVID-19 crisis for Malawi and did not find a significant association after controlling for other factors (although it was significant in bivariate regressions). De

Figueiredo and Larson (2021) found a positive association between belief the government was handling the crisis well and willingness to be vaccinated in a sample of 32 countries with various income levels. Lazarus and colleagues reported the same, but only in bivariate odds ratios. Future analysis is needed to investigate this relationship, preferably using an individual level measure of trust in government rather than the national-level measure used in this analysis.

With respect to our results on changes over time, which showed that changes were minimal in all countries except Iraq, Malawi, and Uzbekistan, where we report relatively large increases. It is difficult to identify the factors that led to increased hesitancy in these cases. The larger body on changes over time in vaccine hesitancy during the same timeframe as the HFPS data were collected is mostly from high-income countries and shows mixed results: increased rates of vaccine hesitancy reported in Australia, Canada and the United States between April and December 2020 (To et al. 2021, Lavoie et al. 2022, Szilagyi et al. 2020), rates remained stable in Italy between June 2020 and January 2021 (Basio et al. 2022) and decreased in Greece between November 2020 and May 2021 (Sypsa et al. 2022).

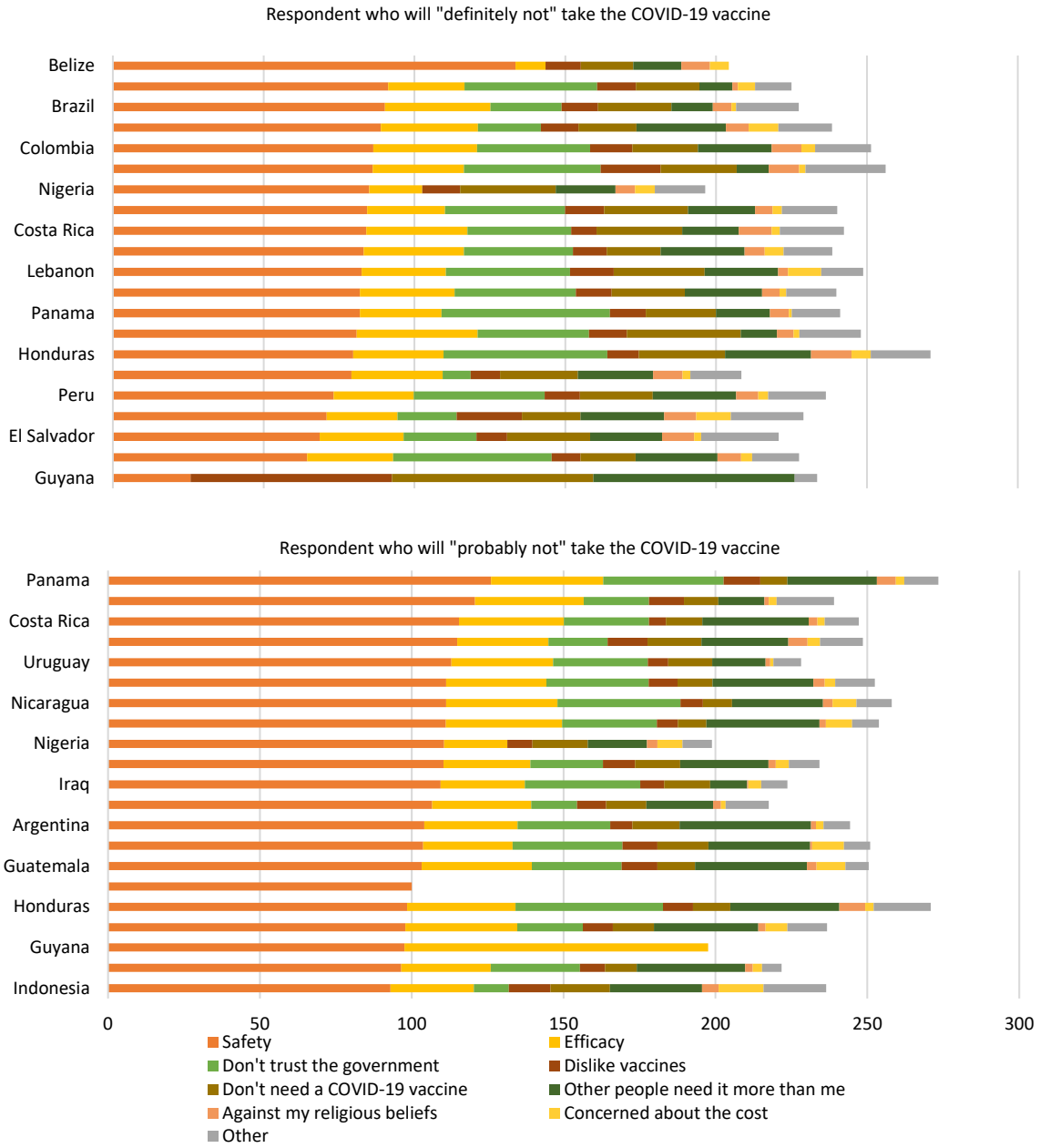
The main reasons reported in the HFPS regarding COVID-19 vaccine hesitancy, which mainly revolve around safety and to a lesser degree efficacy, are consistent with the few studies that report reasons for COVID-19 vaccine hesitancy in low- and middle-income countries and with the main reasons for vaccine hesitancy historically. Solis Arce and colleagues (2021) also reported concerns about side effects to be the most frequently expressed reason in their sample of low- and middle-income countries. Facebook survey results for the same month were available for 21 countries, although reasons for not getting vaccinated were collected separately for respondents who would "definitely not" and "probably not" take the COVID-19 vaccine and multiple reasons were collected. Nevertheless, they show that concerns about safety (worded as "concern about side effects" or "wait and see if it's safe") were the primary concern, followed in most countries by either concerns about efficacy or lack of trust in the government (Figure 11).

Concerns have been raised about supply constraints – both lack of vaccine supply and lack of infrastructure to deliver the vaccines -- being the greatest barrier to COVID-19 vaccination scale-up in developing countries. This study did not find this to be a major concern for respondents (6% average across all surveys with the single answer option). As we noted above, however, the relative incidence of supply-side concerns in the HFPS data may be influenced by the framing of the question, as respondents may have interpreted the question whether they would get vaccinated "when the vaccine becomes available," as indicating a time when current access constraints get resolved. Furthermore, there was a set of small countries in Latin America where over 10% of respondents cited supply constraints as their main concern, specifically "health center too far or hard to reach" or "I don't have time to go to get vaccinated." This finding reinforces the importance citizens place on having easy and quick access, especially in Caribbean countries that are highly dependent on tourism.

Counterindication – that is, believing one should not be vaccinated due to pre-existing health conditions – has been identified has a significant barrier to vaccination in Eastern Europe and Central Asia (World Bank, UNIFEF and JICA 2021). In Georgia, Tajikistan, Uzbekistan, and Kazakhstan, the most common reason for hesitancy was not being eligible (World Bank, UNIFEF and JICA 2021). Indeed, in many countries in that region, medical regulations recommend against vaccination for anyone with a preexisting medical condition. In Uzbekistan it was found that medical personnel interpreted the regulation even more strictly than it was written, regularly refusing to vaccinate persons with a pre-existing condition. For these countries, two policy responses may help to address this challenge: revising standard regulations (which

up until now have recommended against vaccination for people with a wide range pre-existing health conditions, including having had a recent surgery) about who is eligible to be vaccinated, and conducting awareness campaigns for both health care professionals and the public at large to stress the message that vaccination is recommended in nearly all cases, including among people with pre-existing health conditions (World Bank, UNIFEF and JICA 2021).

Figure 11: Reason for "definitely not" (upper panel) or "probably not" (lower panel) taking the COVID-19 vaccine, Facebook data for month of HFPS)



Notes: Y-axes indicate the share of survey respondents; multiple answers were allowed. Data source: Facebook (2021) for same month as reported in the HFPS. The month for each country is reported in Appendix Table 1.

4c. Limitations of this study

One potential limitation of this study is that it is based on phone survey data which exclude respondents who did not have access to a phone. This method of data collection was necessary to collect information quickly during the early months of the COVID-19 pandemic while respecting local movement restrictions and minimizing the risk of COVID-19 transmission. Given that having a phone may be non-random, this might have created a risk that the results are representative only of the population with access to a phone. However, in the countries in this sample, access to mobile phones was high, and in countries where the sample was based on a previous survey, sampling weights were used in the analysis to correct for the biases resulting from non-random access to phones. A recent analysis using the same phone survey samples from four African countries demonstrated that the weighting procedures successfully minimized the selection bias in the phone surveys for a wide range of indicators (Ambel, Mcgee, and Tsegay 2021). Nevertheless, the variation in hesitancy estimates from different data sources, such as the phone surveys vs Facebook, also points to the need for methodological research that would explore further the biases introduced by phone surveys, or by online surveys, vis-à-vis face-to-face surveys. These types of experiments would aid the interpretation of findings in environments where data collection modalities are constrained, as was the case with the COVID-19 pandemic, and would also help guide researchers on issues related to sample corrections.

A second limitation is that country surveys were collected at different times, and some surveys were collected before a vaccine was available in the country while others were collected after the vaccine was available. During data collection (and the pandemic more generally), influential events occurred, including adverse news about side effects of certain vaccines, which could have changed respondents' intentions. Furthermore, there are multiple vaccine manufacturers and types, and the type of vaccine available or anticipated to become available in each country may influence levels of hesitancy.

4d. Conclusions and policy implications

The main findings of this paper are that on average across countries, the level of COVID-19 vaccine hesitancy is approximately 20 percent and remained unchanged in most countries between late 2020 and the first half of 2021. These results suggest that COVID-19 vaccine hesitancy in developing countries, while less prevalent than previously thought, will be an important and enduring obstacle to recovery from the pandemic. The sizeable discrepancies with other studies of COVID-19 vaccine hesitancy suggest that measures of hesitancy depend greatly on the framing of the hesitancy questions and the nature of the sample. Knowing that people over the age of 65 years are the least likely to be hesitant provides an important opportunity to scale up vaccine rollout in this population group, which is at highest risk of severe disease and mortality from COVID-19.

Although supply constraints have long been thought to be the main barrier to vaccination rollout in developing countries, these constraints have abated over time, particularly in middle- and high-income countries. Our results showed only a very small proportion of respondents reported barriers in access or lack of supply as a reason for not getting vaccinated, albeit this may be due, in part, to the framing of the questions. The most cited reasons for hesitancy were concerns about the safety of the vaccine, followed by concerns about its efficacy. At the same time, in many low-income countries, access issues remain important – the estimates in this study showed that about 20 percent of the population was hesitant to get a COVID-19 vaccine, but with only 1 in 5 individuals in low-income countries vaccinated to date, there is still a large share of the population who would get vaccinated if vaccines were made available to them, and alleviating access constraints will remain a policy priority in such contexts.

The estimates of COVID-19 vaccine hesitancy are higher than levels of hesitancy reported towards other vaccines, indicating the challenges in scaling up COVID-19 vaccination campaigns may be even greater than for other diseases. Given the high level, and the persistence of COVID-19 vaccine hesitancy, designing effective vaccination campaigns that address the key concerns underlying vaccine hesitancy will be very important. The results in this study aimed at helping guide policy makers in developing countries in their efforts to scale up national vaccination efforts. In particular, the findings point to the fact that it will be important to design vaccination campaigns that address concerns about safety, especially about side-effects, and that effectively reach younger adults. This will likely call for multi-pronged strategies, given the heterogeneity in information sources across different population groups. For example, in Belize, the government has deployed several initiatives that were successful in increasing vaccine uptake, including door-to-door educational sessions in remote villages via mobile units that were deployed prior to the arrival of vaccination teams, as well as information-sharing via social media and using radio to reach those who lack internet access (Margolies et al., 2022). Providing accurate information about vaccines to the population is very important, but so are questions related to who provides this information, and how it is provided. A World Bank program aimed at supporting developing countries in understanding and reducing vaccine hesitancy using behavioral science has found that personalized messaging is more effective than generic messaging, while certain messengers, such as health care workers and friends/family members, can be more effective than others, pointing to the importance of identifying such messengers within the social networks in groups with high hesitancy rates (Bidani et al., 2022).

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List of Appendix Tables

Appendix Table 1: Description of 53 HFPS surveys

Country	Survey Months	Total Number of households	Sample frame
Antigua and Barbuda	06/2021	790	RDD
Argentina	06/2021	1216	RDD
Belize	06/2021	816	RDD
Bolivia	05/2021	1272	RDD
Brazil	08/2021	2166	RDD
Bulgaria	07/2021	1000	RDD
Burkina Faso	12/2020	1944	Previous survey
Chile	06/2021	1212	RDD
Colombia	06/2021	1221	RDD
Congo, Dem. Rep.	12/2020	986	Previous Survey
Congo, Rep.	12/2020, 03/2021	578, 1495	Previous Survey
Costa Rica	06/2021	802	RDD
Croatia	03/2021	1217	Non-survey list
Dominica	06/2021	861	RDD
Dominican Republic	06/2021	1205	RDD
Ecuador	05/2021	1352	RDD
El Salvador	06/2021	816	RDD
Ethiopia	10/2020, 02/2021	2704, 2178	Previous Survey
The Gambia	12/2020, 04/2021, 08/2021	1334, 1287, 1059	Previous Survey
Georgia	01/2021, 03/2021, 06/2021	2033, 2100, 1936	RDD
Guinea	11/2020	1334	Previous Survey
Guatemala	06/2021	1206	RDD
Guyana	06/2021	785	RDD
Haiti	07/2021	2813	Non-Survey list
Honduras	07/2021	1021	RDD
Indonesia	11/2020, 03/2021	3953, 3555	Previous Survey
Iraq	12/2020, 01/2021,06/2021, 07/2021, 08/2021	1614,1651,1378, 1297,1141	Non-Survey list
Jamaica	06/2021	828	RDD
Kazakhstan	02/2021, 05/2021, 06/2021	917, 1732, 1610	Previous Survey
Kenya	03/2021	6730	Previous Survey

Country	Survey Months	Total Number of households	Sample frame
Lao PDR	03/2021	2153	RDD
Lebanon	03/2021	5113	RDD
Mali	01/2021	1884	Previous Survey
Malawi	11/2020, 03/2021, 04/2021	1589, 1549,1338	Previous Survey
Malaysia	06/2021	2210	RDD
Mexico	06/2021	2624	RDD
Mongolia	12/2020	1147	Previous Survey
Nicaragua	06/2021	833	RDD
Nigeria	02/2021, 10/2020	1699, 1762	Previous Survey
Panama	06/2021	815	RDD
Paraguay	06/2021	1076	RDD
Peru	06/2021	1210	RDD
Philippines	12/2020, 05/2021	1805, 2122	Non-survey list
Saint Lucia	06/2021	835	RDD
Sierra Leone	11/2020	1198	Previous Survey
Sudan	03/2021	2545	Non-Survey list
Tajikistan	05-08/2021	232	Previous Survey
Thailand	05/2021	1786	RDD
Uganda	11/2020, 02/2021	2135, 2121	Previous Survey
Uruguay	06/2021	816	RDD
Uzbekistan	04-06/2021	1496, 1356, 1300	Previous Survey
Vietnam	01/2021	3940	Previous Survey
Zimbabwe	12/2020	1227	Previous Survey

Appendix Table 2a: Survey response options for COVID-19 vaccine hesitancy: distribution of countries by questionnaire type

Questionnaire type 1	Questionnaire type 2	Questionnaire type 3	Questionnaire type 4	Questionnaire type 5	Questionnaire type 6	Questionnaire type 7	Questionnaire type 8	Questionnaire type 9	Questionnaire type 10	Questionnaire LAC	Questionnaire type 11	Questionnaire type 12
Kenya	*Philippines*	*Lebanon*	*Congo, Democratic Republic*	*Guinea*	*Malaysia*	*Mali*	*Gambia, The*	*Lao PDR*	*Cambodia*	*Argentina*	*Kazakhstan*	*Croatia*
Thailand	*Indonesia*		*Republic of Congo*	*Sudan*		*Burkina Faso*		*Mongolia*		*Antigua and Barbuda*	*Kyrgyzstan*	
	Djibouti			*Sierra Leone*		*Uganda*				*Belize*	*Uzbekistan*	
						Ethiopia				*Bolivia*		
						Malawi				*Brazil*		
						Nigeria				*Chile*		
										Colombia		
										Costa Rica		
										Dominica		
										Dominican Republic		
										Ecuador		
										Guatemala		
										Guyana		
										Honduras		
										Haiti		
										Jamaica		
										Mexico		
										Nicaragua		
										Panama		
										Peru		
										Paraguay		
										El Salvador		
										Uruguay		

Appendix Table 2b: Survey response options for COVID-19 vaccine hesitancy: Harmonized answers by questionnaire type

Answer categories	Quest type 1	Quest type 2	Quest type 3	Quest type 4	Quest type 5	Quest type 6	Quest type 7	Quest type 8	Quest type 9	Quest type 10	Quest LAC	Quest type 11	Quest type 12
1. Efficacy	I don't think it will work	I don't think COVID-19 vaccines effective/work	I don't think coronavirus vaccines are effective/work		I don't think vaccines work	I don't think it will work	I don't think it will work	I do not think the vaccine would work against COVID	I don't think COVID-19 vaccines effective/work		I do not think they are effective, that they work		It may not work
						I don't think the vaccines available in my country are effective							
2 Safety (includes side effects)	I don't think it will be safe	I am worried about the safety of the vaccine		Safety of the vaccine	I am worried about the vaccine safety		I don't think it will be safe	I fear the unforeseen future negative side effects from the COVID-19 vaccine	I am worried about the safety of the vaccine	I don't think it is safe		The risk of vaccinating is higher than the benefits	Health risks
	I am worried about the side effects	I am worried about the side effects	I am worried about the side effects of the vaccine			I am worried about the side effects	I'm worried about side effects	I have heard the vaccine has negative side effects	I am worried about the side effects		I don't think it's safe, because of the side effects		
3. Perceive self as low risk	I am not enough at risk of contracting COVID-19	I am strong, I never got any disease in the past	I am not enough at risk of contracting coronavirus			I am not enough at risk of contracting COVID-19	I am not at enough risk of contracting covid-19	I believe I do not need to be vaccinated			I am not at risk of getting covid-19		I am not worried about COVID-19
4.Dislike vaccines in general	I am against vaccines in general	I am against vaccines in general	I am against vaccines in general	General distrust of vaccines	I don't trust the vaccines in general	In general, I don't trust vaccines	I am against the vaccine in general		I am against vaccines in general		I am against vaccines in general	Negative past experiences with vaccines	I am against vaccines in general
5 Religious	It is against my religion	Religious reasons	Religious reasons		I have religious reasons/concerns	It is against my religion.	It's against my religion		Religious reasons		Religious reasons	Personal or religious beliefs	
		I am concerned about its											

Answer categories	Quest type 1	Quest type 2	Quest type 3	Quest type 4	Quest type 5	Quest type 6	Quest type 7	Quest type 8	Quest type 9	Quest type 10	Quest LAC	Quest type 11	Quest type 12
		halal certification											
6 Concerned about getting covid at facility	I'm worried to get infected with COVID-19 at the health facility	I am worried of getting infected with COVID-19 at the health facility	I am worried of getting infected with coronavirus at the health facility			I am worried to get infected with COVID-19 at the health facility.			I am worried to get infected with COVID-19 at the health facility		I am concerned of being infected with covid-19 at the health center		
7 Supply /access barrier	Health facility is too far or too hard to get to		Health facility too far or too hard to get to		It does not suit me (will be given too far or difficult to find)	Health facility too far or too hard to get to		There is shortage of vaccines in the country		I don't know how to access the vaccine	Health center too far or hard to reach		
	I don't have time to get vaccinated/ It will take too long to get vaccinated					It will take too long to get vaccinated/ I don't have time to get vaccinated		There is no vaccination center near my place		I am not the priority group to get the vaccine	I don't have time to go to get vaccinated		
8 Prefer natural immunity (includes already had COVID-19)			I already had coronavirus		I believe that the remedies natural or traditional	I already had COVID-19		I prefer to build immunity against COVID-19 naturally by having the disease			I already had covid-19 / I no longer need it		I already had COVID-19 and do''t need a vaccine
					It is better to leave nature take its course; the COVID symptoms are mostly light								

Answer categories	Quest type 1	Quest type 2	Quest type 3	Quest type 4	Quest type 5	Quest type 6	Quest type 7	Quest type 8	Quest type 9	Quest type 10	Quest LAC	Quest type 11	Quest type 12
9 Distrust (of35overnmentt/pharmaceutical industry/international community)				Be wary of international community	I do''t trust the government/ to the organization who gives the vaccine			I do not trust pharmaceutical companies				Lack of trust to producers of vaccines	I do''t trust the pharmaceutical industry
								I do not trust the government				Lack of trust to heath system or healthcare providers	I do''t trust the government
								I do not trust the COVID-19 vaccines					
								I heard the vaccine is meant to control population growth					
								I do not believe in COVID-19					
10 Not eligible / conterindication								I have underlying health conditions and I believe taking the vaccine will make it worse		I am not eligible to get the vaccine			Counter-indication or prolonged medical discharge
11 Lack of knowledge about COVID 19 Vaccine								I do not have enough information about the vaccine					

Answer categories	Quest type 1	Quest type 2	Quest type 3	Quest type 4	Quest type 5	Quest type 6	Quest type 7	Quest type 8	Quest type 9	Quest type 10	Quest LAC	Quest type 11	Quest type 12
								I did not know that a vaccine exists against COVID-19					
12 Other	Other (specify)	Other (specify)	Some other reason	other	Others	Other (Specify)	other, specify)	Everyday stresses are overwhelming to think about getting vaccinated	Others (specify)	Other, specify	Other (specify)	Other	
		I will wait till more people are vaccinated											
		No one in my neighborhood got it				I am not sure I will get the vaccine I want							

Appendix Table 3: Percent of population hesitant to take the COVID-19 vaccine, HFPS

Average across countries	Percent (%) hesitant to take the COVID-19 vaccine	Confidence Intervals
All countries	20.0	[17.24 , 22.67]
East Asia & Pacific	26.2	[21.38 , 31.02]
Europe & Central Asia	58.8	[55.04 , 62.56]
Latin America & Caribbean	8.0	[6.45 , 9.47]
Middle East & North Africa	47.4	[38.80 , 55.96]
Sub-Saharan Africa	15.5	[11.81 , 19.19]
Low income countries	14.6	[7.82 , 21.39]
Lower middle income countries	27.7	[23.78 , 31.65]
Upper middle income countries	12.7	[9.77 , 15.61]
High income countries	5.9	[3.40 , 8.36]
Urban	17.6	[14.60 , 20.75]
Rural	23.2	[19.83 , 26.64]
Male	17.3	[15.02 , 19.63]
Female	22.5	[18.77 , 26.21]
Head of household	10.8	[12.82 , 18.53]
Non-Head of household	9.4	[17.37 , 26.54]
No education	22.8	[15.36 , 30.31]
Any Primary	19.8	[15.80 , 23.78]
Any Secondary	19.0	[14.64 , 23.42]
Any Tertiary	13.7	[10.56 , 16.83]
Age 34 and younger	20.3	[17.29 , 23.34]
Age 35— 64	20.1	[17.34 , 22.84]
Ages 65 and older	17.8	[13.70 , 21.80]
Antigua and Barbuda	24.5	[22.51 , 26.49]
Argentina	10.1	[8.66 , 11.53]
Belize	28.4	[26.10 , 30.64]
Bolivia	24.3	[22.47 , 26.04]
Brazil	3.1	[2.15 , 4.04]
Bulgaria	66.2	[59.48 , 72.90]
Burkina Faso	23.6	[16.60 , 30.53]
Chile	3.4	[2.22 , 4.57]
Colombia	11.2	[8.91 , 13.51]
Congo, Dem. Rep.	61.2	[61.23 , 61.23]
Congo, Rep.	13.0	[11.20 , 14.79]

Average across countries	Percent (%) hesitant to take the COVID-19 vaccine	Confidence Intervals
Costa Rica	11.9	[9.66 , 14.22]
Croatia	33.2	[29.21 , 37.25]
Dominica	35.9	[32.63 , 39.14]
Dominican Republic	5.0	[2.25 , 7.81]
Ecuador	19.4	[15.54 , 23.21]
El Salvador	8.2	[6.91 , 9.44]
Ethiopia (excludes Eritrea)	3.5	[1.81 , 5.09]
Fm Sudan	23.7	[19.19 , 28.11]
Gambia, The	33.1	[27.44 , 38.70]
Georgia	65.2	[59.62 , 70.72]
Guatemala	29.6	[25.09 , 34.05]
Guinea	20.2	[15.74 , 24.61]
Guyana	20.0	[15.75 , 24.23]
Haiti	58.1	[55.31 , 60.86]
Honduras	13.9	[10.31 , 17.51]
Indonesia	21.4	[17.71 , 25.07]
Iraq	47.4	[38.81 , 55.99]
Jamaica	50.6	[47.11 , 54.03]
Kazakhstan	75.3	[72.39 , 78.18]
Kenya	17.9	[17.11 , 18.74]
Lao PDR	13.0	[9.70 , 16.25]
Lebanon	32.2	[24.56 , 39.84]
Malawi	29.3	[25.03 , 33.54]
Malaysia	25.7	[22.37 , 29.10]
Mali	21.1	[13.14 , 29.03]
Mexico	6.2	[4.85 , 7.55]
Mongolia	19.3	[14.13 , 24.38]
Nicaragua	18.7	[16.04 , 21.40]
Nigeria	16.6	[12.27 , 20.84]
Panama	13.3	[11.12 , 15.49]
Paraguay	15.3	[10.71 , 19.79]
Peru	10.6	[7.55 , 13.59]
Philippines	53.6	[46.28 , 60.83]
Sierra Leone	21.5	[17.31 , 25.66]
St. Lucia	43.2	[38.46 , 47.93]
Tajikistan	26.7	[18.32 , 35.03]
Thailand	36.6	[31.25 , 42.00]
Uganda	11.6	[6.51 , 16.61]
Uruguay	9.1	[5.94 , 12.17]
Uzbekistan	54.6	[50.02 , 59.18]
Vietnam	15.9	[11.72 , 20.14]
Zimbabwe	15.8	[10.42 , 21.14]

Appendix Table 4: Tukey's tests of significance of differences across groups in percent of population hesitant to take the COVID-19 vaccine

Group	Comparison	Difference	Std. Error	t-score	p-value	Signi-ficance
Gender	Female vs Male	0.052	0.022	2.316	0.021	**
Household Status	Head vs Non-Head	-0.063	0.026	-2.398	0.016	**
Age	Ages 65 and older vs Age 35 - 64	-0.023	0.025	-0.937	0.349	
	Ages 65 and older vs Age 34 and younger	-0.026	0.026	-0.994	0.320	
	Age 35 - 64 vs Age 34 and younger	-0.002	0.021	-0.107	0.543	
Education	Any Primary vs Any Secondary	0.008	0.030	0.250	0.599	
	Any Primary vs Any Tertiary	0.061	0.026	2.355	0.019	**
	Any Primary vs No Education	-0.030	0.043	-0.705	0.481	
	Any Secondary vs Any Tertiary	0.053	0.028	1.941	0.052	*
	Any Secondary vs No Education	-0.038	0.044	-0.860	0.390	
	Any Tertiary vs No Education	-0.091	0.041	-2.211	0.027	**
Sector	Rural vs Urban	0.056	0.023	2.375	0.018	**
Region	EAP vs ECA	-0.326	0.031	-10.450	0.000	***
	EAP vs LAC	0.182	0.026	7.077	0.000	***
	EAP vs MENA	-0.212	0.050	-4.219	0.000	***
	EAP vs SSA	0.107	0.031	3.454	0.001	***
	ECA vs LAC	0.508	0.021	24.579	0.000	***
	ECA vs MENA	0.114	0.048	2.390	0.017	**
	ECA vs SSA	0.433	0.027	16.103	0.000	***
	LAC vs MENA	-0.394	0.044	-8.870	0.000	***
	LAC vs SSA	-0.075	0.020	-3.705	0.000	***
	MENA vs SSA	0.319	0.048	6.691	0.000	***

Income Group	HIC vs LIC	-0.087	0.037	-2.368	0.018	**
	HIC vs LMIC	-0.218	0.024	-9.202	0.000	***
	HIC vs UMIC	-0.068	0.020	-3.481	0.001	***
	LIC vs LMIC	-0.131	0.037	-3.559	0.000	***
	LIC vs UMIC	0.019	0.024	0.808	0.419	
	LMIC vs UMIC	0.150	0.025	6.010	0.000	***

Significance levels: *** for p-values <= 0.01, ** for 0.01 < p-values <= 0.05, * for 0.05 < p-values <= 0.1

Appendix Table 5a: Correlates of vaccine hesitancy (Logit model, marginal effects)

Dep. Var: Hesitancy	(1)	(2)	(3)	(4)	(5)	(6)
Male	-0.027*	-0.028*	-0.027*	-0.027*	-0.033**	-0.040***
	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)	(0.011)
Head of HH	0.013	0.009	0.021	-0.001	0.014	0.007
	(0.014)	(0.014)	(0.013)	(0.016)	(0.015)	(0.012)
Education of respondent (ref –						
No education	0.130***	0.131***	0.122***	0.142***	0.133**	0.153***
	(0.036)	(0.037)	(0.033)	(0.040)	(0.044)	(0.040)
Any primary	0.068***	0.069**	0.067***	0.073***	0.059**	0.079***
	(0.020)	(0.021)	(0.020)	(0.020)	(0.022)	(0.023)
Any secondary	0.069***	0.070***	0.068***	0.070***	0.064***	0.067***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Age group (ref. -- 34 and younger)						
Working age (35-64)	-0.047***	-0.048***	-0.042**	-0.050***	-0.046**	-0.049***
	(0.014)	(0.013)	(0.015)	(0.013)	(0.015)	(0.012)
Retirement age (65+)	-0.103***	-0.102***	-0.096***	-0.101***	-0.103***	-0.102***
	(0.024)	(0.025)	(0.024)	(0.023)	(0.025)	(0.024)
Rural area	0.016	0.014	0.015	0.008	0.012	0.011
	(0.019)	(0.018)	(0.017)	(0.015)	(0.015)	(0.011)
Region (ref – LAC)						
EAP	0.189**	0.192*	0.222**	0.095	0.264*	0.188
	(0.067)	(0.078)	(0.077)	(0.069)	(0.130)	(0.130)
ECA	0.313***	0.315***	0.295***	0.328***	0.313***	0.295***
	(0.055)	(0.057)	(0.056)	(0.059)	(0.040)	(0.062)
MNA	0.208***	0.212***	0.245***	0.216***	0.282***	0.369***
	(0.037)	(0.040)	(0.062)	(0.032)	(0.059)	(0.051)
SSA	0.074	0.081	0.070	-0.022	0.047	0.022
	(0.075)	(0.077)	(0.070)	(0.105)	(0.083)	(0.104)
Income group (ref. – LIC)						
LMIC	-0.068	-0.065	-0.045	-0.088	-0.054	-0.071
	(0.122)	(0.119)	(0.112)	(0.123)	(0.097)	(0.069)
UMIC	-0.047	-0.038	-0.066	-0.095	-0.035	-0.137
	(0.149)	(0.148)	(0.130)	(0.150)	(0.116)	(0.087)
HIC	-0.173	-0.164	-0.190	-0.223	-0.202	-0.309***
	(0.163)	(0.160)	(0.143)	(0.164)	(0.130)	(0.090)
Survey month (ref -- Nov 2020 - Jan						
March - May 2021	-0.069	-0.060	-0.094	-0.056	-0.095	-0.083
	(0.095)	(0.108)	(0.103)	(0.098)	(0.104)	(0.095)
June - August 2021	-0.029	-0.025	-0.024	-0.052	-0.057	-0.055
	(0.088)	(0.098)	(0.100)	(0.087)	(0.092)	(0.075)
New COVID-19 cases per million, terciles (ref. – bottom tercile)						
Cases (middle tercile)		-0.017				0.026
		(0.067)				(0.060)
Cases (top tercile)		-0.019				-0.016
		(0.057)				(0.047)
Oxford stringency index terciles (ref. – bottom tercile)						
Stringency (middle tercile)			0.065			0.134
			(0.072)			(0.070)
Stringency (top tercile)			-0.008			0.027
			(0.076)			(0.068)
WHO excess deaths due to COVID-19 terciles (ref.- bottom tercile)						
Excess deaths (middle tercile)				-0.117*		-0.109
				(0.052)		(0.072)

Dep. Var: Hesitancy	(1)	(2)	(3)	(4)	(5)	(6)
Excess deaths (top tercile)				-0.069		0.040
				(0.072)		(0.108)
Confidence in government index tercile (ref.- top tercile)						
Confidence in government					0.048	0.070
					(0.053)	(0.057)
Confidence in government					0.024	0.053
					(0.097)	(0.103)
Pseudo R-squared	0.0745	0.0748	0.0794	0.0813	0.0869	0.1067
N	65088	65088	65088	65088	65088	65088

Notes: Weighted logit regressions. Marginal effects reported. Standard errors clustered at country level. *, **, *** indicates significance at the 95%, 99%, and 99.9% level.

Appendix Table 5b: Correlates of vaccine hesitancy (Ordinal logit regression, marginal effects)

Dep. Var.:	Would you get the vaccine?		
	No	Not sure	Yes
Male	-0.025**	-0.007**	0.036**
	(0.01)	(0.002)	(0.011)
Head of HH	0.011	0.001	-0.006
	(0.012)	(0.002)	(0.011)
Education of respondent (ref – Tertiary)			
No education	0.119***	0.022**	-0.156***
	-0.028	(0.007)	(0.038)
Any primary	0.057**	0.013**	-0.080***
	-0.018	(0.004)	(0.022)
Any secondary	0.058***	0.012***	-0.068***
	(0.009)	(0.003)	(0.010)
Age group (ref. -- 34 and younger)			
Working age (35-64)	-0.040***	-0.009***	0.049***
	(0.010)	(0.002)	(0.012)
Retirement age (65+)	-0.079***	-0.018***	0.097***
	(0.020)	(0.005)	(0.025)
Rural area	0.010	0.002	-0.012
	(0.009)	(0.002)	(0.011)
Region (ref – LAC)			
EAP	0.149	0.034	-0.183
	(0.093)	(0.021)	(0.113)
ECA	0.238***	0.055***	-0.293***
	(0.044)	(0.016)	(0.058)
MNA	0.288***	0.066***	-0.354***
	(0.042)	(0.011)	(0.049)
SSA	0.015	0.004	-0.019
	(0.082)	(0.019)	(0.101)
Income group (ref. – LIC)			
LMIC	-0.074	-0.017	0.091
	(0.055)	(0.012)	(0.067)
UMIC	-0.109	-0.025	0.134
	(0.069)	(0.017)	(0.085)
HIC	-0.241***	-0.056**	0.297***
	(0.071)	(0.019)	(0.088)
Survey month (ref -- Nov 2020 - Jan 2021)			
March - May 2021	-0.054	-0.011	0.065
	(0.081)	(0.016)	(0.098)
June - August 2021	-0.046	-0.010	0.055
	(0.065)	(0.012)	(0.077)
New COVID-19 cases per million, terciles (ref. – top tercile)			
Cases (middle tercile)	0.016	0.003	-0.019
	(0.048)	(0.010)	(0.058)
Cases (bottom tercile)	-0.028	-0.006	0.034
	(0.037)	(0.008)	(0.045)
Oxford stringency index terciles (ref. – top tercile)			
Stringency (middle tercile)	0.089	0.020	-0.110
	(0.057)	(0.013)	(0.070)
Stringency (bottom tercile)	0.012	0.003	-0.015
	(0.041)	(0.011)	(0.052)

Dep. Var.:	Would you get the vaccine?		
	No	Not sure	Yes
WHO excess deaths due to COVID-19 terciles (ref.- bottom tercile)			
Excess deaths (middle tercile)	-0.075	-0.019	0.094
	(0.057)	(0.015)	(0.071)
Excess deaths (top tercile)	0.057	0.010	-0.067
	(0.096)	(0.015)	(0.112)
Confidence in government index tercile (ref.- top tercile)			
Confidence in government (middle tercile)	0.052	0.016	-0.069
	(0.041)	(0.013)	(0.054)
Confidence in government (bottom tercile)	0.040	0.013	-0.053
	(0.070)	(0.023)	(0.093)
R-squared		0.0866	
N		65088	

Notes: Weighted ordinal logit regressions. Categories ranked from no to not sure to yes. Marginal effects reported. Standard errors clustered at country level. *, **, *** indicates significance at the 95%, 99%, and 99.9% level.

Appendix Table 6: Percent of population non-hesitant to take the COVID-19 vaccine, 14 countries with multiple rounds of survey results (95% confidence intervals in parentheses).

country	**Oct-2020**	**Nov-2020**	**Dec-2020**	**Jan-2021**	**Feb-2021**	**Mar-2021**	**Apr-2021**	**May-2021**	**Jun-2021**	**Jul-2021**	**Aug-2021**
Burkina Faso			0.79 (0.73, 0.86)						0.76 (0.67, 0.86)		
Congo, Rep.			0.84 (0.75, 0.94)			0.87 (0.81, 0.93)					
Ethiopia	0.98 (0.91, 1.00)				0.97 (0.89, 1.00)						
Gambia, The			0.65 (0.58, 0.71)				0.55 (0.49, 0.60)				0.67 (0.60, 0.74)
Georgia				0.36 (0.33, 0.38)		0.29 (0.27, 0.32)			0.35 (0.32, 0.38)		
Indonesia		0.79 (0.73, 0.85)				0.79 (0.72, 0.85)					
Iraq			0.66 (0.61, 0.72)	0.50 (0.45, 0.54)					0.45 (0.40, 0.50)	0.47 (0.42, 0.52)	0.53 (0.47, 0.58)
Kazakhstan					0.23 (0.17, 0.28)			0.32 (0.27, 0.37)	0.25 (0.21, 0.29)		
Malawi		0.83 (0.76, 0.89)				0.52 (0.47, 0.58)	0.71 (0.64, 0.78)				
Nigeria	0.86 (0.80, 0.93)				0.83 (0.77, 0.90)						
Philippines			0.44 (0.40, 0.48)					0.46 (0.42, 0.51)			
Tajikistan								0.73 (0.61, 0.84)	0.79 (0.67, 0.92)	0.80 (0.65, 0.95)	0.73 (0.57, 0.90)
Uganda		0.84 (0.79, 0.90)			0.88 (0.83, 0.94)						
Uzbekistan							0.55 (0.51, 0.60)	0.50 (0.46, 0.54)	0.45 (0.41, 0.49)		

Appendix Table 7: Comparison of results on vaccine hesitancy from the HFPS and other studies

Comparison with de Figueiredo and Larson (2021)		
	HFPS	**de Figueiredo and Larson**
Argentina	10.1%	24.3%
Brazil	3.1%	17.0%
Chile	3.4%	27.9%
Croatia	33.2%	58.5%
Ecuador	19.4%	20.3%
Indonesia	21.3%	17.1%
Lebanon	32.2%	55.9%
Malaysia	25.8%	13.9%
Mexico	6.2%	18.0%
Nigeria	15.2%	35.9%
Paraguay	15.3%	48.5%
Peru	10.5%	28.3%
Vietnam	15.9%	3.2%
Average	*16.3%*	*28.4%*
Comparison with Wouters et al. 2021		
	HFPS	**Wouters et al.**
Argentina	10.1%	24.0%
Brazil	3.1%	12.0%
Chile	3.4%	28.0%
Croatia	33.2%	59.0%
Ecuador	19.4%	20.0%
Indonesia	42.6%	17.0%
Lebanon	32.2%	56.0%
Mexico	6.2%	18.0%
Nigeria	30.3%	36.0%
Paraguay	15.3%	49.0%
Peru	10.5%	28.0%
Vietnam	15.9%	2.0%
Average	*18.5%*	*29.1%*
Comparison with Gallup (2021)		
Country	**HFPS Hesitancy**	**Gallup**
Argentina	10.1%	37.0%
Bolivia	24.2%	35.0%
Brazil	3.1%	30.0%
Burkina Faso	22.2%	44.0%
Chile	3.4%	40.0%
Colombia	11.2%	30.0%
Congo, Dem. Rep.	61.2%	61.2%
Congo, Rep.	14.4%	48.0%

Costa Rica	11.9%	26.0%
Croatia	33.2%	57.0%
Dominican Republic	5.0%	35.0%
Ecuador	19.4%	28.0%
El Salvador	8.1%	25.0%
Ethiopia	2.8%	16.0%
Georgia	66.8%	44.0%
Guatemala	29.6%	29.0%
Guinea	20.1%	46.0%
Honduras	13.9%	30.0%
Indonesia	21.3%	30.0%
Iraq	47.8%	39.0%
Jamaica	50.6%	68.0%
Kenya	17.9%	27.0%
Lao PDR	12.9%	16.0%
Lebanon	32.2%	57.0%
Malaysia	25.8%	28.0%
Mali	21.1%	51.0%
Mexico	6.2%	25.0%
Mongolia	19.2%	39.0%
Nicaragua	18.8%	13.0%
Nigeria	15.2%	42.0%
Paraguay	15.3%	47.0%
Peru	10.5%	27.0%
Philippines	54.9%	49.0%
Tajikistan	23.7%	36.0%
Thailand	36.6%	39.0%
Uganda	13.6%	38.0%
Uruguay	9.1%	39.0%
Uzbekistan	49.8%	30.0%
Vietnam	15.9%	19.0%
Zimbabwe	15.8%	27.0%
Average	*22.4%*	*36.2%*
Comparison with Facebook (2021)		
Country	**HFPS**	**FB**
Argentina	10.1%	21.5%
Belize	28.4%	48.0%
Brazil	3.1%	25.8%
Chile	3.4%	43.0%
Colombia	11.2%	15.7%
Costa Rica	11.9%	17.1%
Ecuador	19.4%	17.1%

El Salvador	8.1%	15.8%
Guatemala	29.6%	18.6%
Guyana	20.0%	54.4%
Honduras	13.9%	13.7%
Indonesia	21.3%	19.2%
Iraq	47.8%	52.8%
Lebanon	32.2%	22.3%
Mexico	6.2%	13.0%
Nicaragua	18.8%	37.4%
Panama	13.3%	24.9%
Paraguay	15.3%	16.2%
Peru	10.5%	12.2%
Uruguay	9.1%	50.8%
Average	*16.7%*	*27.0%*