Measuring Vaccine Acceptance and Uptake in LMICs: Challenges and Insights

Key Findings

- Vaccine acceptance estimates varied widely by how respondents were recruited and interviewed, and did not reliably predict self-reported vaccine uptake or administrative data on vaccination rates.

- Acceptance estimates from surveys conducted during an ongoing pandemic provided minimal guidance to develop vaccination campaigns and supply chain planning.

- Nearly all interview modes – including both remote and face-to-face modes – resulted in vaccine uptake estimates that were substantially higher than administrative data.

- Surveys using household recruitment with face-to-face interviews produced vaccine uptake estimates that were generally closer to administrative data than other methods. In contrast, surveys using online and social media recruitment either significantly under- or overestimated uptake, showing greater divergence from administrative data.

POLICY BRIEF

Survey design – the way we ask questions and how we select people to ask – may contribute to misleading estimates. Survey-based estimates of vaccine acceptance vary widely, including by recruitment method and interview mode. Survey-based estimates of vaccine uptake are closer to administrative data when in-person recruitment methods and in-person or phone interviews are used.

The Survey Measurement Challenge

Accurate measurement of vaccine acceptance and uptake is important to public health decision making, as survey data guides decisions on vaccine distribution, resource allocation, and demand-generation activities. Survey design, such as the choice to use phones or online platforms to conduct interviews, may influence how respondents answer, and sample recruitment methods may over- or under-represent certain population segments, leading to a skewed picture of vaccine attitudes and behavior. Little research has been directed at how survey design may affect results in low- and middle-income countries (LMICs).

During the COVID-19 pandemic, survey research in LMICs shifted from primarily household recruitment[1] and face-to-face interviews to remote recruitment and interviews using phone and internet, which reduced the cost and time of data collection, but raised new questions about data quality and validity of research findings. To better understand the role of survey design on self-reported vaccine acceptance and uptake estimates, we analyzed data from 11 multi-country projects across 14 African countries. This brief shares the findings, concluding with lessons for researchers and policymakers.

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1 We use the term household recruitment To describe sampling methods based on geographic probability-based sampling using robust population data to draw a high-quality sample and developing sampling weights to compensate for any demographic imbalances.

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Study Methodology

The analysis presented in this brief was conducted using data from 11 multi-country projects that surveyed COVID-19 vaccine attitudes and behaviors across 14 African countries. We compared COVID-19 vaccine acceptance rates (people who were willing to get vaccinated) across different surveys conducted in the same countries and time periods to assess the consistency of results.[1] We also compared vaccine uptake rates (people who reported already being vaccinated with at least one dose) to administrative estimates.[2]

The projects used different recruitment methods (the way people are recruited to participate in a survey) and interview modes (if participants answered an online survey, completed it over the phone, or in person). Household recruitment involves in-person recruitment or collection of phone numbers using geographic probability sampling based on nationally representative census data. Call list recruitment uses lists of active phone numbers from telecom operators or previous surveys, while random-digit dialing (RDD) uses randomly generated phone numbers. Other surveys rely on recruitment from social media platforms. Interviews were administered face-to-face, over the phone through computer-assisted telephone interviews (CATI) or interactive voice response (IVR), and self-administered via the internet.

We plotted survey estimates of vaccine acceptance and uptake for each country and quarter, as illustrated for Nigeria (Figure 1). Vaccine availability and administrative estimates of uptake are also included in the figure. Since administrative estimates may count some minors, who were not included in surveys, these figures serve as an upper bound for comparison with survey estimates.
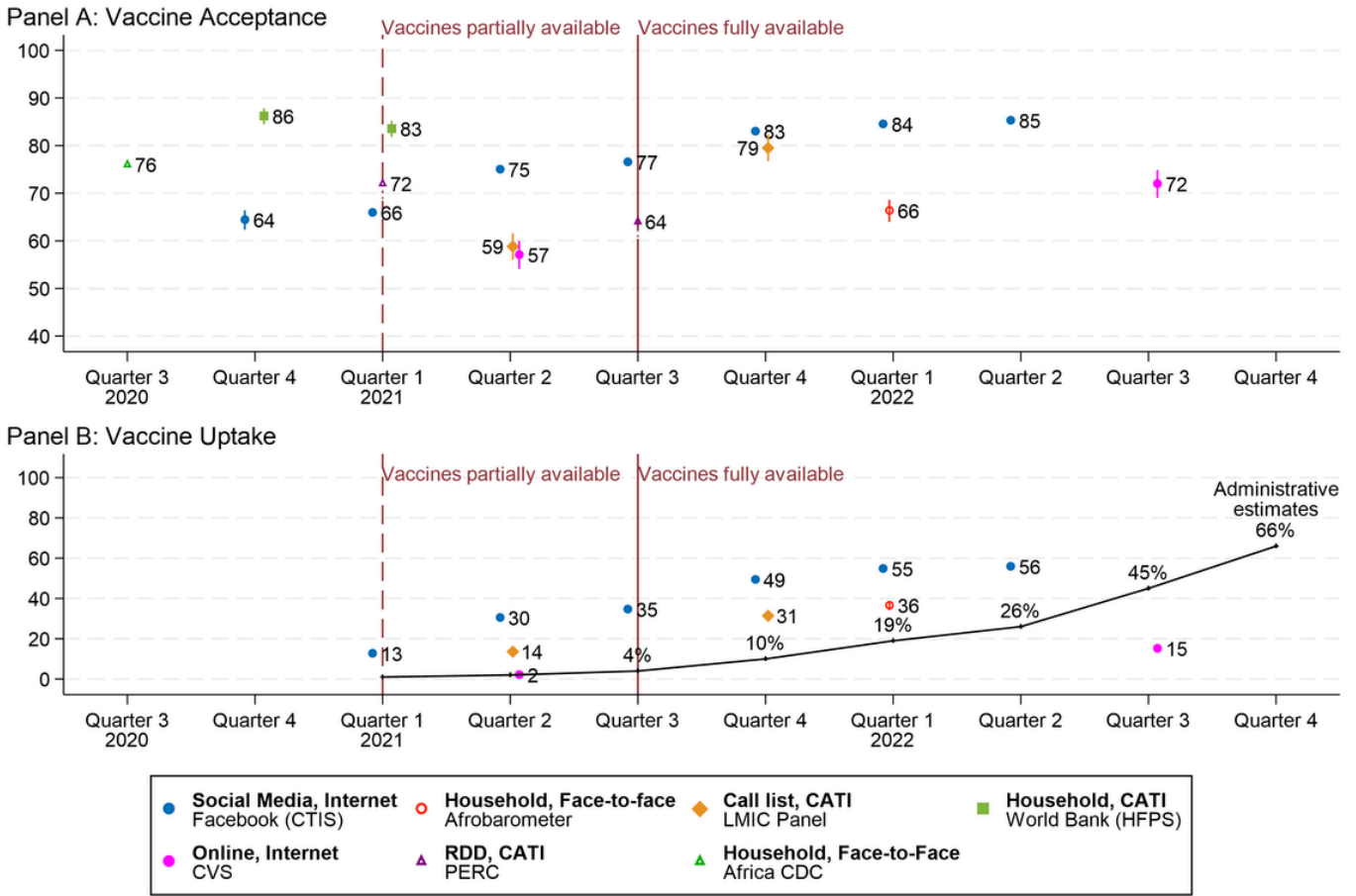
Key Findings

Vaccine acceptance estimates varied widely by recruitment method and interview mode

Within the same country and time period, we found that different surveys produced varying estimates of respondents' willingness to accept the vaccine. While some differences are minor, in many instances the estimates vary by ten or more percentage points. As there is no administrative data on vaccine acceptance to serve as a benchmark, there is no way to know which estimates are more accurate.

For example, Figure 1 illustrates that in Nigeria, during five of the six periods with overlapping surveys, acceptance estimates differ by 17 to 22 percentage points. Even among surveys using the same interview mode—internet—the estimates differed by 18 percentage points in Quarter 2 of 2021. Only in one period of overlapping surveys were the acceptance estimates relatively close: in Quarter 4 of 2021, estimates from the survey using call list recruitment and CATI interviews (Call list-CATI) and the survey using social media recruitment and internet interviews (Social Media-Internet) were within four percentage points of each other. This was not the case in Quarter 2 of 2021 when the estimates from these surveys differed by 16 percentage points highlighting that in addition to recruitment method and interview mode, the timing of surveys likely influences acceptance estimates.

Figure 1: Nigeria Case Study

Panel A: Vaccine Acceptance

Panel B: Vaccine Uptake

Legend:
- **Social Media, Internet** Facebook (CTIS) — blue filled circle
- **Online, Internet** CVS — magenta filled circle
- **Household, Face-to-face** Afrobarometer — red open circle
- **RDD, CATI** PERC — purple open triangle
- **Call list, CATI** LMIC Panel — orange filled diamond
- **Household, Face-to-Face** Africa CDC — green open triangle
- **Household, CATI** World Bank (HFPS) — green filled square

Examining the data from other countries (not shown) reveals multiple instances where overlapping surveys produce differing results. In nine countries, the discrepancies between overlapping survey estimates reach up to 15 percentage points. In three countries - Ghana, Uganda, and Ethiopia - these differences exceed 30 percentage points in certain periods, highlighting significant variability in survey outcomes.

Surveys ovestimated vaccine uptake

Vaccination rates estimated from surveys were substantially higher than administrative estimates, regardless of recruitment method or interview mode. In the study sample, 84% of the quarterly estimates exceeded administrative data by at least 10 percentage points. In over two-thirds of the samples, the difference exceeded 20 percentage points. Figure 1 Panel B presents self-reported vaccine uptake, compared with administrative estimates, represented by the black trend line. With the exception of surveys using online recruitment and internet interviews (online-internet), all surveys across rounds produced vaccine uptake estimates that were higher than administrative estimates. Estimates from surveys using social media recruitment and internet interviews (social media-internet) ranged from 13 to 40 percentage points above administrative estimates, while call list-CATI survey estimates were closer to administrative estimates, with an average gap of 16 percentage points.

Table 1 shows the average difference between self-reported vaccine uptake, pooled across recruitment methods and interview modes, and administrative estimates for each country we examined. The average difference across all countries is 14 percentage points, indicating that nearly all surveys led to overestimated uptake rates. In Morocco, surveys underestimated vaccine uptake, while in Tunisia and Uganda, self-reported uptake estimates were closer to administrative estimates. Standard deviations of 7 to 21 percentage points suggest that within country the amount by which the estimates from a given survey at a given time point (quarter) diverged from administrative data were sometimes close to zero and sometimes twice as large as the average, meaning that any single survey might be even more of a shot in the dark.

Table 1: Differences in uptake with administrative estimates by country (percentage points) [2]

Country	Mean difference (Std. Dev.)	Country	Mean difference (Std. Dev.)
Burkina Faso (n=11)	14 (12)	Morocco (n=8)	-11 (7)
Cote d'Ivoire (n=6)	12 (9)	Niger (n=1)	12 (-)
Ethiopia (n=5)	21 (11)	Nigeria (n=11)	18 (20)
Ghana (n=9)	14 (20)	Senegal (n=5)	28 (13)
Kenya (n=11)	20 (21)	Sudan (n=8)	17 (11)
Malawi (n=1)	13 (-)	Tunisia (n=7)	4 (7)
Mali (n=6)	22 (12)	Uganda (n=4)	6 (8)

What could explain these discrepancies? While it is possible that governments systematically under-report the number of vaccine doses administered, this seems less likely than over-reporting given knowledge of supply chains and strong incentives to achieve vaccination targets. More likely, the issue is with the surveys. Survey recruitment may not reach a representative sample of adults, with a bias towards the participation of respondents who have received a vaccine. Alternatively, respondents may misreport their vaccination status. A look at variation in estimates by recruitment method provides further insights.

Household recruitment typically provided uptake estimates closer to administrative data

Overall, surveys that used household recruitment methods provided vaccine uptake estimates that were generally closer to administrative records, with lower or comparable variability to other recruitment methods. In contrast, online and social media recruitment methods either significantly under- or overestimated uptake, showing greater divergence from administrative data. These findings highlight the reliability of surveys that employ household recruitment methods for producing more accurate national vaccine uptake estimates, regardless of the interview mode used.

Table 2 presents mean differences between vaccine uptake survey estimates and administrative data by recruitment method and interview mode. Surveys that used household recruitment and face-to-face (F2F) interviews showed a mean difference of six percentage points, with a standard deviation of 13 percentage points across 12 countries, indicating relatively close alignment with administrative estimates but with some variability. Surveys that used household recruitment and CATI interviews had a similar but slightly higher mean difference (nine percentage points) and a smaller standard deviation, based on six estimates from two countries. These findings suggest surveys that used household recruitment and either F2F or CATI interviews aligned reasonably well with administrative estimates.

Conversely, surveys that used call list or social media recruitment overestimated vaccine uptake, each with mean differences exceeding 15 percentage points. The only survey that underestimated vaccine uptake used online recruitment and internet interviews.

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2 The sample size refers to the number of data points compared to administrative figures. A data point corresponds to the uptake rate reported by a survey in a specific quarter pooled across recruitment method and interview mode combination. Mean difference refers to the gap between the share of uptake by country and administrative estimates. Differences between self-reported uptake and administrative estimates are calculated at the country-quarter level. A positive mean difference indicates that self-reported uptake exceeds administrative estimates.

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Table 2: Differences in uptake with administrative estimates, by recruitment and interview mode[3]

Survey		Count		Mean Difference (Std. Dev.)
Recruitment	Interview	Estimates	Countries	
Household	F2F	15	12	6 (13)
Household	CATI	6	2	9 (1)
Call list	CATI	6	3	15 (12)
Online	Internet	6	3	-14 (14)
Social media	Internet	60	11	19 (15)
All	All	93	14	14 (17)

Vaccine acceptance did not reliably predict vaccine uptake

While vaccine acceptance – respondents' stated willingness to vaccinate – is tempting to use as a predictor of later vaccine uptake, a comparison of acceptance and uptake estimates across countries shows a significant disconnect. In the majority of countries, even the lowest acceptance estimates were more than double the administrative data estimated vaccination rates by mid-2022 in the 14 African LMICs in the study. In Nigeria, across surveys an average of 74% of respondents expressed willingness to receive the vaccine in early 2021 when vaccines became available to some adults. However, by mid 2022, despite vaccine availability for all adults, only 26 to 45% reported being vaccinated. This gap suggests that although respondents may have been willing to be vaccinated, access barriers and changes in priorities during the evolving pandemic context may have limited uptake. Respondents may have deprioritized vaccination due to distance or wait times, changing perceptions, misinformation about effectiveness, or low COVID-19 case numbers.

Lessons for Researchers and Policymakers

The observational basis of this analysis means that we could not systematically vary recruitment methods, interview modes, or question design, so many possible explanations for the findings are confounded or unmeasurable. Nevertheless, based on available evidence, we can point to four key lessons to guide researchers, policymakers, and funders of survey research in the interpretation and design of studies intended to guide public health and other critical public policy decisions.

Survey design meaningfully influences estimates of vaccine acceptance and uptake.

This analysis underscores the need for careful selection of recruitment methods and interview modes in public health research. The results suggest that all the survey designs implemented during the pandemic period should be considered with a degree of skepticism, both because they do not cluster tightly around common values for attitudes (vaccine acceptance rates), nor do they line up closely with administrative data.

Building nationally-representative panels based on probability sampling ahead of crises will facilitate access to higher quality samples during a crisis.

Sample selection is a particular concern when there is uncertainty around how demographics may impact survey response. Pandemics and other crises both motivate researchers to implement remote surveys and limit the ability of national statistical offices to produce high-quality, updated benchmarks for sampling weighting. Building and maintaining high-quality panels complete with mobile or other remote contact information enables researchers to rapidly deploy surveys to representative samples. In addition, wherever possible, triangulating across methods could provide insurance against the bias inherent in any one methodology, such as with mixed mode surveys.

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3 Estimates represent the number of data points compared to administrative figures for each recruitment method and interview mode combination. A data point corresponds to the uptake rate reported by a survey in a specific quarter. Countries denote the number of distinct countries included in the comparison with administrative estimates for that particular recruitment method and interview mode combination. Mean difference refers to the gap between the share of uptake from each recruitment method and interview mode combination and administrative estimates. A positive mean difference indicates that self-reported uptake exceeds administrative estimates.

Social media (Facebook) surveys are temptingly inexpensive and are fast, but they may produce severely biased estimates in LMICs.

Social media recruitment with online interviews, as implemented in the Facebook CTIS (COVID-19 trends and impact survey), produced consistently higher estimates of vaccine acceptance than any of the other survey projects. Because this was the only social media recruitment survey project in the analysis, the data cannot be used to identify which explanations drive findings. Differences could be due to the platform, which limits respondents to those using Facebook, or the opt-in method of recruiting respondents, leading to sample selection bias towards those individuals most concerned with the survey topic; Or, it may be attributed to the self-administered online interview mode, or the question or questionnaire design of this specific project. Integrating research into future survey designs will clarify the extent of bias involved in implementing high-speed, low-cost social media surveys across a range of topics in LMICs.

Survey design research in LMICs should urgently take up questions of optimization of survey design before the next public health crisis.

This study has identified significant variation in estimates across a range of recruitment and interview methods. Future surveys would benefit from mixed recruitment strategies and interview modes with well-tested question design, which would allow survey efforts to benefit from lower-cost data collection for some of the sample, while allowing for data validation and targeted sampling of hard-to-reach populations using more costly methods. Systematic studies and randomized experiments should be used to isolate the impacts of questionnaire design, recruitment method, and interview mode effects. While the proceeding analysis drew on data from 11 survey projects, there was still a limited number of variations in recruitment method and interview mode combinations. As such, the analysis provides only suggestive evidence for whether "house effects" related to the identity of the survey organization or methodologies drove the results.