

Health Systems, Trust and Immunisation Governance Dynamics: Mixed-Methods Evidence from Zambia

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Abstract

Background:

Vaccine uptake during public health emergencies reflects not only access but also institutional credibility and governance capacity. The COVID-19 vaccine rollout provided an opportunity to examine how trust, communication systems and health system performance shaped patterns of immunisation uptake in lower middle-income settings. This study analysed determinants of vaccine uptake among priority groups in Zambia through a health systems and governance lens.

Methods:

A concurrent mixed-methods study was conducted across five provinces in Zambia. Quantitative data were collected from 3,059 participants (including from the health sector, academia, religious groups, public service, defence forces and business sectors) using disproportionate stratified sampling. Binary logistic regression was used to examine determinants of receipt of at least one COVID-19 vaccine dose through staged modelling: demographics, institutional trust and information ecosystem variables. Institutional trust was operationalised as a composite index (Cronbach's $\alpha = 0.84$). Qualitative data from focus group discussions and key informant interviews were analysed thematically and mapped to the WHO determinants of vaccine hesitancy framework and a governance lens.

Results:

Overall, 69.2% of participants reported receiving at least one vaccine dose. Higher institutional trust was independently associated with vaccination in adjusted models, with participants in the high-trust category having more than twice the odds of uptake compared with those with low trust (AOR 2.32, 95% CI 1.83–2.95). Trust in one's primary information source was also strongly associated with vaccination (AOR 2.20, 95% CI 1.76–2.76). Qualitative findings indicated that concerns regarding transparency, policy consistency and health worker confidence were associated with vaccination decisions, alongside perceptions of service reliability and communication coherence.

Conclusion:

COVID-19 vaccine uptake among priority groups in Zambia was strongly associated with trust in official health information and institutional credibility, interpreted here as proxy indicators of governance performance. Strengthening epidemic preparedness and routine immunisation systems requires sustained investment in transparent communication, workforce confidence and trust-building mechanisms as core components of health system resilience.

Introduction

Immunisation systems remain among the most effective public health interventions globally, particularly for achieving universal health coverage goals [1]. However, vaccine availability alone does not guarantee uptake. Increasingly, vaccine acceptance is understood as a function of institutional trust, governance capacity and the effectiveness of risk communication systems. Large cross-national analyses demonstrate substantial variation in vaccine confidence across countries, with implications for coverage and system legitimacy [2, 3].

The COVID-19 pandemic functioned as a global stress test for health systems and governance structures [4–6]. Beyond clinical burden, the pandemic exposed structural weaknesses in coordination, transparency and communication, particularly in lower middle-income countries [5, 7, 8]. The rapid development and deployment of COVID-19 vaccines required public confidence in regulatory institutions, political leadership and frontline health workers. In many contexts, hesitancy was influenced by safety concerns, misinformation and distrust in government institutions rather than supply constraints alone [5, 9–13].

In sub-Saharan Africa, vaccine hesitancy has been shaped by political trust, social norms, perceived risk and communication ecosystems [11, 14, 15]. Although early discourse emphasised vaccine inequity and access limitations, evidence from low- and middle-income country surveys indicates that acceptance levels are sensitive to confidence in authorities and perceptions of safety and intent [15, 16]. These determinants extend beyond COVID-19 and are central to the sustainability of routine immunisation programmes and preparedness for future outbreaks. The reasons for vaccine hesitancy are complex and require a multifaceted approach [15, 17].

Zambia's COVID-19 vaccine rollout provides an important case through which to examine how institutional trust and governance factors, as health system performance facets, condition vaccine uptake among priority populations. Early programme experience indicated slower than anticipated uptake in some priority categories, against a background of circulating concerns regarding adverse effects and fertility-related rumours [12, 13]. Strengthening immunisation systems in line with the Immunisation Agenda 2030 requires sustained attention to demand-side constraints, including public confidence, misinformation and governance challenges [17, 18].

Conceptually, vaccine decision-making can be understood as a governance-sensitive outcome, reflecting how individuals interpret risk, credibility, institutional intent and overall health system performance. Situating vaccine uptake within a health systems lens shifts the focus from COVID-19 as a time-bound emergency to vaccination as an indicator of broader system performance, including the quality of communication, accountability mechanisms and the social contract between health authorities and communities.

This study therefore examined determinants of COVID-19 vaccine uptake among priority groups across five provinces in Zambia using a concurrent mixed-methods design. By interpreting uptake patterns

through a health systems, trust and immunisation governance framework, the study aimed to generate insights relevant beyond the COVID-19 context, informing strategies to strengthen institutional trust, improve risk communication and reinforce immunisation governance in Zambia and comparable lower middle-income settings.

Conceptual Framework

This study was guided by an integrated conceptual framework combining the World Health Organisation (WHO) determinants of vaccine hesitancy model with a health systems governance and institutional trust lens.

The WHO framework conceptualises vaccine hesitancy as a complex and context-specific phenomenon influenced by three broad domains: (1) contextual influences, including political, socio-cultural and communication environments; (2) individual and group influences, such as beliefs, risk perception and social norms; and (3) vaccine- or vaccination-specific issues, including confidence in safety, delivery systems and programme design [19]. This model emphasises that vaccine decision-making is shaped by structural and relational factors beyond individual knowledge deficits.

However, while the WHO determinants framework provides a useful typology of influences, it does not explicitly situate vaccine uptake within broader health system governance dynamics, which are critical to understanding how trust, communication and system performance shape vaccination outcomes. Recent global analyses highlight that vaccine confidence is closely linked to trust in institutions, perceived transparency in decision-making and credibility of public authorities [3, 14, 15]. Trust operates not only at the interpersonal level between patient and provider, but also at the institutional level, reflecting confidence in regulatory systems, political leadership and public health stewardship [17].

Health systems governance frameworks emphasise accountability, transparency, responsiveness and participation as core system functions influencing public legitimacy [8]. During public health emergencies, governance quality becomes particularly visible, as rapid policy shifts, evolving scientific guidance and risk communication strategies test institutional credibility [7]. In such contexts, vaccine uptake can be interpreted as an outcome of both service delivery capacity and governance performance.

In this study, institutional trust was conceptualised as a cross-cutting determinant linking the WHO domains. Contextual influences, such as media narratives and political discourse, shape trust in government and health authorities. Individual and group influences, including perceived risk and social norms, interact with levels of confidence in institutions. Vaccine-specific concerns, particularly regarding safety and side effects, are interpreted through the lens of perceived transparency and regulatory integrity.

By integrating the WHO determinants model with a governance perspective, the framework positions vaccine uptake as a signal of health system functioning rather than solely as an indicator of individual

hesitancy. This approach allows examination of how trust deficits, communication gaps and structural inequalities converge to influence vaccination decisions among priority groups.

The integrated framework guided both quantitative variable selection and qualitative thematic analysis. Survey variables were mapped to contextual, individual and vaccine-specific domains, while qualitative analysis explored how narratives of trust, governance and institutional credibility shaped vaccine perceptions. This dual application enabled triangulation of findings and interpretation of uptake patterns within a broader health systems strengthening agenda.

Figure 1 illustrates the integrated conceptual framework guiding the study.

Methods

Study Design and Setting

A concurrent mixed-methods design was used, integrating quantitative cross-sectional survey (appendix 1) data with qualitative key informant interviews (appendix 2) and focus group discussions (appendix 3 and appendix 4). Data were collected during the national COVID-19 vaccine rollout across five provinces in Zambia, between July and October 2021. The rollout prioritised healthcare workers, essential service providers, individuals with comorbidities, older adults and populations in congregate settings, and was delivered through fixed and outreach vaccination sites. The study used COVID-19 vaccine uptake as an outcome lens through which to examine institutional trust and perceived immunisation governance dynamics.

Study Population and Sampling

The quantitative component captured participants drawn from designated priority groups, including the health sector, academia, religious groups, public service, defence forces and business sectors, through an online survey administered via SurveyMonkey. The study aimed to achieve broad geographic coverage across provinces and diversity across key stakeholder groups, building on approaches used in earlier work to ensure representation across settings and sectors.

Participants were recruited using a targeted non-probability approach. Multiple strategies were employed to maximise reach, including social media posting and advertising, dissemination of the survey link through institutions aligned to the priority groups, and direct distribution to selected groups whose contact details had been made available. These included health care workers reached through the Health Professions Council of Zambia, the Ministry of Health and the Expanded Programme on Immunisation (EPI) partners. This combined approach was intended to enhance participation across provinces and ensure inclusion of key stakeholder groups that may otherwise have been underrepresented. While the sampling approach did not allow for population-level inference, it was

appropriate for capturing perspectives across diverse stakeholder groups relevant to the study objectives.

The qualitative component used purposive sampling to obtain in-depth insights into participants' experiences, perceptions and attitudes related to trust, governance and communication. Participants were identified with the support of district and provincial health directors, as well as health facility in-charges, to ensure inclusion of key informants across different levels of the health system and relevant community groups.

A total of 18 qualitative data collection activities were conducted, comprising key informant interviews with provincial health office staff, district health office staff, and health facility staff. In addition, focus group discussions were conducted with community members and community health workers. Overall, 238 participants took part in the qualitative component. These interviews and discussions provided deeper contextual understanding of the factors influencing perspectives and experiences, drawing on both provider and community viewpoints.

Data Collection

A structured questionnaire was administered online via SurveyMonkey to collect data on socio-demographic characteristics, vaccination status, perceived risk, trust in government and health institutions, information sources, and perceptions of vaccine safety and misinformation. The questionnaire was informed by the WHO determinants of vaccine hesitancy framework and adapted to the local context. Qualitative data were collected using key informant interview (KII) guides and focus group discussion (FGD) guides.

Measures

The primary outcome was self-reported receipt of at least one dose of a COVID-19 vaccine. Independent variables were grouped according to the integrated conceptual framework and included socio-demographic characteristics, perceived risk, trust in institutions, information sources and vaccine-specific safety concerns. Likert-scale items were categorised for analysis where appropriate. Internal consistency of trust-related measures were assessed using Cronbach's alpha where scales were constructed.

Trust in official health information (hereafter referred to as institutional trust for conceptual consistency) was operationalised using three items measuring respondents' trust in Ministry of Health COVID-19 infection statistics, death statistics and vaccine-related information. Internal consistency of these items was assessed using Cronbach's alpha ($\alpha = 0.84$), supporting their aggregation into a composite institutional trust index. The index was categorised into low, medium and high trust based on tertile distribution for analytical interpretation.

The main source of COVID-19 information was categorised into Ministry of Health broadcast updates, Ministry of Health digital platforms, social media, television, workplace and other sources. Trust in the main source was measured on a three-point scale (“not at all”, “a little”, “very much”) and treated as an ordinal variable.

These variables were interpreted as proxy indicators of governance performance, as outlined in the conceptual framework

Statistical Analysis

Binary logistic regression was used to examine determinants of receipt of at least one dose of a COVID-19 vaccine. A staged modelling approach was employed to assess the incremental explanatory contribution of institutional trust and information ecosystem variables, interpreted within the study as proxies for governance performance. Model 1 included socio-demographic characteristics (age, sex, education, province and residential area). Model 2 added the institutional trust index. Model 3 further incorporated main source of information and trust in the main source. Adjusted odds ratios (AORs) with 95% confidence intervals were reported. Model fit was assessed using likelihood ratio tests and changes in pseudo R^2 across stages. Statistical significance was set at $p < 0.05$. Cases with missing outcome data were excluded from regression analyses.

Qualitative Analysis

Qualitative data were analysed using thematic analysis. An initial coding framework was developed deductively from the WHO determinants domains and governance constructs and refined inductively through transcript review. Themes were organised around institutional trust, risk communication, governance transparency and social influence. Findings were triangulated with quantitative results during interpretation. Themes were organised around institutional trust, risk communication, governance transparency and social influence, consistent with the integrated conceptual framework in the study.

Ethical Considerations

Ethical approval was obtained from the ERES Converge (Ref. No. 2021- Jun- 013) as well as the National Health Research Authority (Ref No: NHRA00025/15/07/2021). Administrative authorisation was granted by the Ministry of Health and participating institutions. Written informed consent was obtained from all participants. Data were anonymised and stored securely.

Findings

Quantitative Findings

Table 1
Participant Characteristics and Vaccination Uptake (n = 3,059)

Variable	Category	n (%)	Vaccinated n (%)	p-value
Vaccination status (overall)	≥ 1 dose	2,117 (69.2)	—	—
	Not vaccinated	942 (30.8)	—	—
Sex	Female	1,621 (53.0)	1,114 (68.7)	0.56
	Male	1,438 (47.0)	1,003 (69.7)	
Residence	Urban/Peri-urban	2,174 (71.1)	1,548 (71.2)	0.021
	Rural	885 (28.9)	569 (64.3)	
Age group	18–24	386 (12.6)	207 (53.6)	< 0.001
	25–34	891 (29.1)	598 (67.1)	
	35–44	801 (26.2)	593 (74.0)	
	45–54	536 (17.5)	427 (79.7)	
	55–64	289 (9.4)	234 (81.0)	
	≥ 65	156 (5.1)	124 (79.5)	
Education level	Higher/Tertiary	2,638 (86.2)	1,920 (72.8)	< 0.001
	Secondary	285 (9.3)	146 (51.2)	
	Primary	109 (3.6)	43 (39.4)	
	None	27 (0.9)	8 (29.6)	
Institutional trust index	Low	712 (23.3)	384 (53.9)	< 0.001
	Medium	1,137 (37.2)	785 (69.0)	
	High	1,210 (39.5)	935 (77.3)	
Trust in main information source	Very much	2,362 (77.2)	1,741 (73.7)	< 0.001
	A little	657 (21.5)	354 (53.9)	
	Not at all	40 (1.3)	22 (55.0)	

Vaccine Uptake and Sample Characteristics

Table 1 shows that a total of 3,059 participants were included in the quantitative analysis. Overall, 69.2% (2,117/3,059) reported having received at least one dose of a COVID-19 vaccine, while 30.8% (942/3,059) had not been vaccinated at the time of the survey.

Participants were predominantly highly educated, with 86.2% reporting tertiary-level education. The largest age groups were 25–34 years (29.1%) and 35–44 years (26.2%), with smaller proportions in older age categories.

Model 1: Socio-Demographic Determinants of Uptake

In the baseline model including socio-demographic variables only, age and education were strongly associated with vaccination status (Table 2).

Compared with participants aged 18–24 years, older age groups had progressively higher odds of vaccination. For example, participants aged 45–54 years had significantly higher odds of uptake (OR 2.88, 95% CI 1.90–4.37), with similar magnitudes observed for those aged 55–64 years (OR 3.25, 95% CI 1.92–5.51) and 65 years and above (OR 3.41, 95% CI 1.49–7.79).

Education demonstrated a pronounced gradient. Compared with participants with higher education, those with secondary education had lower odds of vaccination (OR 0.21, 95% CI 0.16–0.29), and those with primary education had substantially lower odds (OR 0.11, 95% CI 0.06–0.20). Sex and province were not consistently associated with uptake in the fully adjusted demographic model.

Model 2: Addition of Institutional Trust

Institutional trust was introduced in Model 2 using a composite index derived from three items measuring trust in Ministry of Health COVID-19 statistics and vaccine-related information (Cronbach's alpha = 0.84).

Institutional trust showed a strong and graded association with vaccine uptake (Table 2). Compared with participants in the low-trust category, those with medium institutional trust had higher odds of vaccination (AOR 1.41, 95% CI 1.11–1.79), while those in the high-trust category had more than twice the odds of vaccination (AOR 2.32, 95% CI 1.83–2.95).

The inclusion of institutional trust attenuated some of the age and education coefficients, though these remained statistically significant. This indicates that institutional trust contributed additional explanatory power beyond socio-demographic characteristics.

Model 3: Addition of Information Source and Trust in Main Source

Model 3 incorporated participants' main source of COVID-19 information and their reported level of trust in that source. Trust in the main source was independently associated with uptake. Compared with participants who reported trusting their main source "a little," those who trusted it "very much" had significantly higher odds of vaccination (AOR 2.20, 95% CI 1.76–2.76). The small number reporting "no trust" yielded imprecise estimates.

When main source categories were examined, using Ministry of Health broadcast updates as the reference category, reliance on general television as the primary source was associated with lower odds of vaccination (AOR 0.52, 95% CI 0.37–0.73). Reliance on social media as the main source was not independently associated with uptake after adjusting for institutional trust and trust in the source.

The addition of source-related variables resulted in a modest improvement in model fit and modestly reduced the magnitude of the institutional trust coefficient, though institutional trust remained a strong independent predictor of vaccination.

Institutional trust remained significantly associated with uptake, with participants in the high-trust category having higher odds of vaccination (AOR 2.11, 95% CI 1.65–2.69). The association between institutional trust and vaccination attenuated modestly following inclusion of information ecosystem variables but remained independently significant in the fully adjusted model.

Marital status and religious affiliation were included as adjustment variables; however, neither demonstrated independent associations with vaccination in fully adjusted models and their inclusion did not materially alter the strength of association between institutional trust and vaccine uptake.

Table 2
Multivariable Logistic Regression Models for Receipt of ≥ 1 COVID-19 Vaccine Dose (n = 3,059)

Variable	Model 1 (Demographics) AOR (95% CI)	Model 2 (Demographics + Institutional Trust) AOR (95% CI)	Model 3 (Demographics + Institutional Trust + Information Ecosystem) AOR (95% CI)
Age (ref: 18–24)			
25–34	1.72 (1.27–2.34)	1.61 (1.18–2.19)	1.54 (1.12–2.11)
35–44	2.31 (1.69–3.17)	2.05 (1.49–2.83)	1.97 (1.42–2.74)
45–54	2.88 (1.90–4.37)	2.52 (1.65–3.86)	2.44 (1.59–3.74)
55–64	3.25 (1.92–5.51)	2.98 (1.75–5.08)	2.87 (1.67–4.93)
≥ 65	3.41 (1.49–7.79)	3.12 (1.35–7.23)	3.05 (1.30–7.15)
Education (ref: Higher)			
Secondary	0.21 (0.16–0.29)	0.24 (0.18–0.33)	0.26 (0.19–0.35)
Primary	0.11 (0.06–0.20)	0.14 (0.08–0.25)	0.16 (0.09–0.29)
None	0.09 (0.03–0.26)	0.12 (0.04–0.34)	0.14 (0.05–0.39)
Sex (Male vs Female)	1.06 (0.90–1.25)	1.04 (0.88–1.23)	1.02 (0.86–1.21)
Residence (Urban vs Rural)	1.32 (1.10–1.59)	1.21 (1.01–1.46)	1.17 (0.97–1.41)
Marital status (Married vs Not married)	1.18 (0.99–1.41)	1.10 (0.92–1.32)	1.06 (0.88–1.27)
Religion (Ref: Catholic)			
Protestant	0.97 (0.79–1.19)	0.99 (0.80–1.23)	1.01 (0.81–1.26)
Pentecostal	0.91 (0.73–1.14)	0.94 (0.75–1.18)	0.96 (0.76–1.22)
Other	0.88 (0.60–1.30)	0.92 (0.62–1.36)	0.95 (0.63–1.42)
Institutional Trust (ref: Low)	—		
Medium	—	1.41 (1.11–1.79)	1.34 (1.05–1.71)
High	—	2.32 (1.83–2.95)	2.11 (1.65–2.69)
*- denotes significant factors			

Variable	Model 1 (Demographics) AOR (95% CI)	Model 2 (Demographics + Institutional Trust) AOR (95% CI)	Model 3 (Demographics + Institutional Trust + Information Ecosystem) AOR (95% CI)
Age (ref: 18–24)			
Trust in Main Source (ref: A little)	—	—	
Very much	—	—	2.20 (1.76–2.76)
Not at all	—	—	0.91 (0.45–1.83)
Model fit (Pseudo R ²)	0.18	0.26	0.31
*- denotes significant factors			

Qualitative Findings

A total of 18 focus group discussions and 19 key informant interviews were conducted across five provinces. Participants included healthcare workers, community members and local leaders from designated priority groups. Themes were organised according to the WHO determinants of vaccine hesitancy domains, while foregrounding institutional trust and governance dynamics.

a. Contextual Determinants: Institutional Legitimacy, Health System Performance and Communication Environment

Institutional Legitimacy and Political Suspicion

Across provinces, participants expressed concerns regarding government transparency and vaccine procurement processes. Some health workers linked their hesitation to perceived irregularities in institutional decision-making.

“Some of my colleagues don’t feel comfortable taking the vaccine because of the several scandals they have witnessed at the MOH... there was a story we heard recently that a batch of vaccines we had accepted was rejected by South Africa, so if they rejected it why did our government accept it.” KIIs

Community members also associated vaccination campaigns with broader political processes.

“Other people in the community don’t believe COVID-19 exists and it is just a hoax being used by the PF government to win the elections.” KIIs

Health System Performance and Constraints

Findings indicated operational challenges encountered during the vaccine rollout, including vaccine and stock management processes and service delivery limitations.

“We are told not to open a vial of 10 doses... unless there are at least more than 5 people... Many people give up waiting and they are lost to get vaccinated.” Klls

Health workers also reported concerns related to workload and limited incentives.

“There are no incentives being provided despite working even on your off days.” Klls

Transport barriers in rural areas were similarly noted.

“The Community Volunteers are working hard, walk long distances to reach some far villages... they need some form of transport and incentives to motivate them.” Klls

Communication Environment and Information Ecosystem

Participants identified social media as a major source of information, often linked to the spread of unverified claims.

“Social media is the least reliable source of information because it has no regulations and anyone can post whatever they want which can be misleading.” Klls

Religious and community narratives were also described as influencing perceptions.

“Some churches continuously spread false rumours that once vaccinated one would get spiritually linked to the sign of the beast ‘666’.” FGDs

b. Individual and Group Influences: Conditional Trust and Social Mediation

Conditional and Observational Decision-Making

Several participants described initial reluctance followed by eventual vaccination after observing outcomes among others.

“Yes, there was resistant to get the vaccine initially by most health workers but later on with the 3rd wave most of them got COVID-19 which forced them to get the vaccine.” Klls

Others referenced personal anxiety prior to vaccination.

“Participant 1 was initially anxious when she heard about vaccine rumours circulating but fortunately, she had no side effect after the jab.” FGDs

Family dynamics also shaped decisions.

“When my daughter was not comfortable with my taking up vaccine, I told her it’s my choice and problem and in case I die, just bury me in dignity.” FGDs

Health Workers as Influential Intermediaries

Health workers were described as influential in shaping community perceptions, but some reported personal hesitation.

“Most of health workers are not yet vaccinated... there was serious reluctance on the part of the health workers to get the vaccine.” KIIs

One health worker stated, “In the beginning I never wanted to get the vaccine because I did not trust the information.” KIIs

c. Vaccine-Specific Issues: Safety and Fertility Concerns

Concerns regarding vaccine safety were frequently reported, particularly in relation to fertility and long-term health effects.

“The vaccine reduces fertility and lowers libido in men... magnetic effects... slow poisoning... those who get vaccinated will die within 2 years.” KIIs

At the same time, some participants described minimal adverse events among those vaccinated.

“Some people who were vaccinated reported minimal side effects such as headache, chills, and body malaise... We have never had anyone coming in with severe effects.” KIIs

Discussion

The COVID-19 vaccination rollout in Zambia functioned as a real-world stress test of immunisation governance. The findings of this study suggest that vaccine uptake was not solely a function of access constraints or individual knowledge deficits, but rather a reflection of institutional credibility, information system coherence and perceived governance integrity. These reflect broader health system performance perceptions. In this sense, COVID-19 vaccination served as a diagnostic lens through which underlying strengths and vulnerabilities of the health system became visible. In Zambia, where routine childhood immunisation coverage has historically been high, these findings highlight the fragility of adult vaccine confidence in emergency contexts.

Institutional trust as governance infrastructure

The independent association between institutional trust and vaccine uptake underscores the centrality of trust as a structural component of health systems, rather than a peripheral behavioural variable. The graded relationship observed between trust in Ministry of Health information and vaccination status suggests that public confidence operates as a form of governance capital. Where institutional credibility

is high, vaccine uptake is more likely; where credibility is contested, hesitancy is more likely. This finding aligns with global analyses demonstrating that trust in public institutions is a decisive predictor of compliance with public health interventions during emergencies [17, 20]. The Lancet Commission on COVID-19 emphasised that pandemic response effectiveness was shaped less by resource levels alone and more by governance coherence and public legitimacy [8]. The present study reinforces this argument in a lower middle-income country context, demonstrating that institutional trust remained independently associated with vaccination even after controlling for education and demographic factors.

For immunisation governance, this implies that trust-building must be conceptualised as core strategies. Investment in surveillance systems, cold chain and logistics must be paralleled by investment in transparent communication, accountability mechanisms and visible integrity in decision-making processes. The Immunisation Agenda 2030 recognises community engagement as central to programme resilience; the present findings suggest that this engagement must extend beyond one-off consultation to sustained, visible actions -such as consistent messaging, transparent decision-making and reliable service delivery -that reinforce institutional credibility over time [18].

Information ecosystems and epistemic authority

The association between trust in one's primary information source and vaccination uptake highlights the importance of epistemic authority within immunisation systems. Participants who reported high trust in their main information channel were significantly more likely to be vaccinated, irrespective of the channel itself. This suggests that the governance challenge is not merely controlling misinformation but strengthening the perceived reliability of authoritative sources.

Globally, pandemic misinformation has been characterised as an “infodemic,” reflecting the rapid amplification of unverified claims across digital platforms [7]. However, emerging evidence suggests that misinformation thrives particularly where institutional trust is already fragile [9]. The attenuation of source-type effects once institutional trust was included in the model supports this interpretation: the credibility of institutions may condition how information from various channels is interpreted.

Policy responses should therefore prioritise coherence and consistency across communication channels. Fragmented messaging or visible contradictions between political and technical actors can erode trust even when factual information is available. Governance frameworks that integrate behavioural science, community intermediaries and transparent data reporting are likely to be more resilient than reactive, crisis-driven communication strategies.

Education gradients and structural inequities

The strong education gradient observed in vaccination uptake raises broader equity considerations. While higher educational attainment was associated with increased likelihood of vaccination, the persistence of institutional trust effects after adjustment suggests that education alone does not neutralise governance dynamics. This aligns with cross-country analyses demonstrating that education enhances health literacy but does not fully compensate for low institutional confidence [16].

From a policy perspective, this finding highlights the need to address structural inequities in trust formation. Communities with historically limited engagement with state institutions may require differentiated approaches that go beyond information provision. Strengthening local accountability mechanisms, involving trusted community actors and ensuring service reliability may be more effective than mass communication alone.

Health workforce confidence as system amplifier

Qualitative findings indicated that ambivalence among some health workers influenced community perceptions. This observation carries significant implications. Health workers function not only as service providers but as symbolic representatives of system credibility. If internal system confidence is weak, external trust may deteriorate. Recent analyses from African settings have similarly emphasised that frontline provider confidence is a prerequisite for sustaining vaccine demand [14].

Strengthening immunisation governance therefore requires internal trust alignment. Transparent training, consistent policy guidance and mechanisms for addressing frontline concerns should be prioritised in future vaccination campaigns.

Operational reliability and symbolic governance

Participants' references to logistical constraints and vaccine handling practices demonstrate that operational performance contributes to trust formation. Governance is experienced not only through communication but through observable service reliability. Delays, inconsistencies or visibly wasteful practices may signal systemic fragility, even if vaccines are available.

This reinforces the broader systems literature indicating that performance legitimacy and procedural legitimacy are interlinked [8]. Ensuring predictable, efficient delivery may strengthen institutional credibility and indirectly improve demand.

Implications for epidemic preparedness

The relevance of these findings extends beyond COVID-19. Future vaccination campaigns, whether for emerging respiratory pathogens, Ebola or other epidemic threats, will depend on public confidence in governance structures. Treating trust as a measurable and monitorable system asset could enhance preparedness planning. Integrating trust indicators into routine monitoring frameworks may allow earlier identification of erosion in public confidence.

This study advances the interpretation of vaccine uptake as a governance-sensitive system indicator. In this regard, vaccine uptake during COVID-19 can be interpreted as a measurable signal of governance performance, particularly in relation to trust, communication coherence and operational reliability. Where uptake lagged despite availability, this may indicate areas requiring investment in communication coherence, accountability or workforce engagement. Pandemic preparedness strategies that focus

solely on procurement and distribution without addressing institutional trust may face recurrent resistance.

Reframing vaccine hesitancy in LMIC contexts

The dominant narrative around vaccine hesitancy often frames it as an individual attitudinal deficit. The present findings support a more structural interpretation. In Zambia, hesitancy reflected negotiated judgments about institutional credibility, information reliability and perceived system performance. This interpretation resonates with broader scholarship emphasising that vaccine confidence is socially embedded and politically conditioned [3, 14].

Policy responses should therefore avoid framing hesitancy as ignorance or irrationality. Instead, strengthening governance transparency, consistent communication and equitable service delivery may address underlying drivers more effectively than punitive or coercive strategies.

Limitations and analytical considerations

The cross-sectional design limits causal inference between institutional trust and vaccination behaviour. The use of an online, non-probability sample may have resulted in overrepresentation of highly educated and digitally connected individuals, potentially overestimating vaccine uptake and limiting generalisability of the findings. Additionally, the institutional trust index focused primarily on trust in official health information and may not capture broader dimensions of institutional trust. The cross-sectional design also limits interpretation of the directionality of associations observed. It is possible that trust and vaccination behaviour are mutually reinforcing, such that individuals who choose to vaccinate may subsequently report higher levels of trust in institutions. These limitations should be considered when interpreting the findings.

Conclusion

This study demonstrates that vaccine uptake during the COVID-19 rollout among surveyed groups was strongly associated with institutional trust and perceived immunisation governance. Institutional credibility, coherent information ecosystems and operational reliability emerged as central determinants of vaccination. Strengthening immunisation systems in lower middle-income settings therefore requires sustained investment in trust architecture, transparent communication and internal workforce alignment. Pandemic preparedness is not solely a logistical challenge; it is fundamentally a governance challenge.

Declarations

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Ethics approval and consent to participate.

Ethical approval was obtained from the ERES Converge (Ref. No. 2021- Jun- 013) as well as the National Health Research Authority (Ref No: NHRA00025/15/07/2021). Authorisation was granted by the Ministry of Health and participating institutions. Written informed consent was obtained from all participants. Data were anonymised and stored securely. Study methodology and all tools, including key informant interview guides and data extraction tools were reviewed by the ethics board, NHRA and MOH. Informed consent was obtained from all the participants. All methods were carried out in accordance with relevant guidelines and regulations of the ethics board and NHRA.

Consent for publication

Not applicable.

Availability of data and materials

Data is available on request from the corresponding author.

Competing interests

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

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Figures

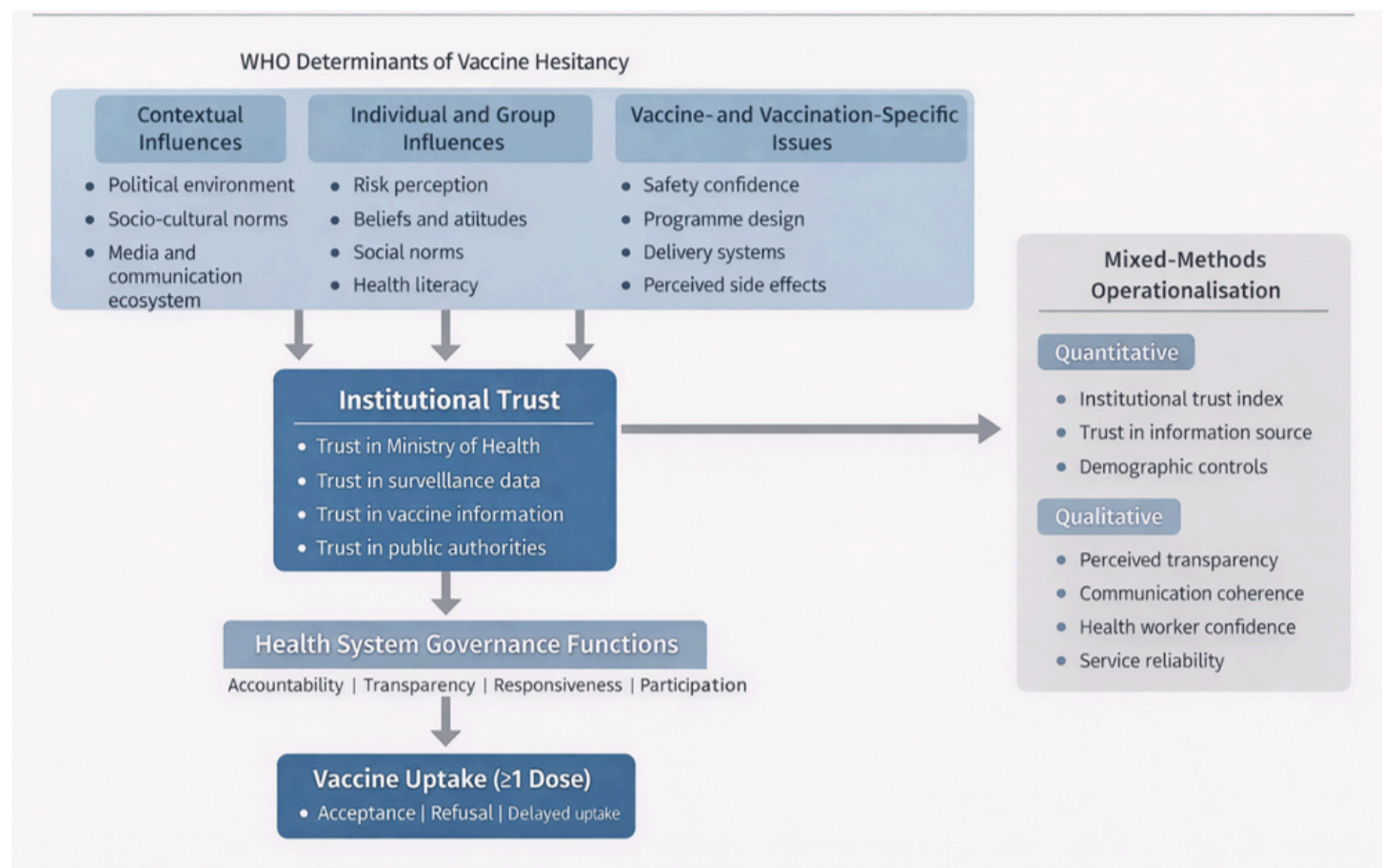


Figure 1

Integrated conceptual framework illustrating how WHO determinants of vaccine hesitancy interact with institutional trust and health system governance functions to influence vaccine uptake

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix1SurveyQuestionnaire.pdf](#)
- [Appendix2KeyInformantInterviewScheduleHealthStaff.pdf](#)
- [Appendix3FocusGroupDiscussionGuideCommunityMembers.pdf](#)
- [Appendix4FocusGroupDiscussionGuideCommunityGroups.pdf](#)