World Journal of Advanced Studies
www.worldstudiesjournal.com
Online ISSN:
Received: 18-12-2025, Accepted: 19-01-2026, Published: 03-02-2026
Volume 2, Issue 1, Jan-Mar, 2026, Page No. 12-16

Determinants of COVID-19 vaccine hesitancy among adults in Sub-Saharan Africa: A cross-sectional epidemiological investigation

Dr. Chidinma Okafor
Associate Professor, Department of Epidemiology and Public Health, University of Nigeria, Nsukka, Nigeria

Abstract
Background: Vaccine hesitancy has emerged as one of the foremost public health challenges threatening global immunisation goals, particularly in sub-Saharan Africa, where complex socioeconomic, cultural, and informational dynamics impede vaccine uptake.
Objective: This study aims to identify and quantify the sociodemographic, attitudinal, and informational determinants of COVID-19 vaccine hesitancy among adults in sub-Saharan Africa.
Method: A cross-sectional survey design was employed with 420 adult participants selected through stratified random sampling across urban, peri-urban, and rural settings. Data were collected using a validated structured questionnaire and analysed using descriptive statistics and binary logistic regression in SPSS v29.
Key Results: The overall vaccine hesitancy rate was 37.4%. Exposure to misinformation (OR = 3.74, 95% CI: 2.47–5.67), healthcare system distrust (OR = 2.66), and low health literacy (OR = 2.10) were the strongest positive predictors. Tertiary education (OR = 0.44) was a significant protective factor. Hesitancy was substantially higher in rural areas (54.8%) compared with urban areas (30.0%).
Conclusion: Vaccine hesitancy in sub-Saharan Africa is a multifactorial phenomenon driven primarily by informational and institutional factors. Community-based health communication strategies tailored to local epistemological contexts are urgently required.

Keywords: Vaccine hesitancy, COVID-19, sub-Saharan Africa, health literacy, misinformation, logistic regression

Introduction

The global rollout of COVID-19 vaccines represented one of the most ambitious public health endeavours in modern history. Yet despite the scientific consensus on vaccine efficacy and safety [1, 2], a substantial proportion of populations across sub-Saharan Africa continued to exhibit hesitancy toward vaccination [3]. The World Health Organization (WHO) identifies vaccine hesitancy as one of the ten most significant threats to global health [4], characterising it as a delay in acceptance or outright refusal of vaccines despite their availability [5].

Sub-Saharan Africa presents a particularly complex epidemiological and social context. Historical experiences of unethical medical experimentation, persistent systemic inequities in healthcare access, widespread exposure to health misinformation through social media platforms, and variable health literacy levels converge to produce an environment in which vaccine hesitancy is both predictable and difficult to address [6, 7]. These dynamics were acutely visible during the COVID-19 vaccination campaigns, where even freely available vaccines experienced low uptake in several countries [8].

The determinants of vaccine hesitancy are well recognised in the global literature as multidimensional, encompassing individual-level cognitive factors, social and community-level influences, and systemic or institutional variables [9]. The "3Cs" model proposed by the WHO's Strategic Advisory Group of Experts (SAGE) on immunisation identifies confidence, complacency, and convenience as the core axes of hesitancy [10]. However, the applicability and weighting of these dimensions differ markedly across regional contexts, necessitating context-specific empirical investigations [11].

Despite a growing body of literature on vaccine hesitancy globally, there remains a paucity of region-specific quantitative studies examining the interplay between sociodemographic variables, attitudinal constructs, and information exposure patterns in sub-Saharan Africa [12, 13]. Most existing studies draw on qualitative methodologies or are limited to single-country contexts, restricting the generalisability of their findings [14].

This study addresses this gap by conducting a cross-sectional epidemiological investigation among 420 adult participants across urban, peri-urban, and rural settings. The study aims to: (i) estimate the prevalence of COVID-19 vaccine hesitancy in the study population; (ii) identify the sociodemographic, attitudinal, and informational predictors of hesitancy; and (iii) derive evidence-based implications for targeted public health communication interventions [15].

Literature Review

1. Theoretical Framework

The theoretical underpinning of this study draws on the WHO SAGE Working Group's 3Cs Vaccine Hesitancy Model (confidence, complacency, and convenience) [10], supplemented by the Health Belief Model (HBM) [16]. The HBM posits that health behaviour is determined by an individual's perceived susceptibility to disease, perceived severity of the condition, perceived benefits of the health action, and perceived barriers to that action [16, 17]. Applied to vaccine hesitancy, the model predicts that individuals with lower perceived COVID-19 severity or higher

perceived vaccine risks are more likely to refuse or delay vaccination [17].

Larson *et al* [18]. proposed an expansion of the 3Cs model to account for the "4th C" — calculation — referring to the deliberate weighing of risks and benefits by hesitant individuals. This cognitive dimension is particularly relevant in contexts where circulating misinformation distorts risk-benefit calculations [18, 19].

2. Empirical Evidence

MacDonald *et al* [5]. established the foundational definitional and conceptual framework for vaccine hesitancy, delineating it as context-specific and vaccine-specific, influenced by a constellation of factors including personal beliefs, social norms, and institutional variables. Subsequent empirical work has confirmed that in African settings, distrust of healthcare systems — rooted in colonial histories and contemporary governance failures — constitutes one of the most robust predictors of hesitancy [6, 20].

A multi-country study by Solís Arce *et al* [21]. across 15 low- and middle-income countries (LMICs), including several in sub-Saharan Africa, found that willingness to vaccinate was high at the population level but masked considerable within-country heterogeneity. Educational attainment and urban residence were consistently associated with greater vaccine acceptance [21]. Similarly, Reno *et al* [22]. documented in a systematic review that health literacy was inversely correlated with hesitancy, with lower literacy individuals exhibiting significantly higher susceptibility to vaccine misinformation.

The role of social media misinformation has been extensively documented as an accelerant of hesitancy [23]. Roozenbeek *et al* [24]. demonstrated that COVID-19 misinformation exposure significantly reduced vaccine acceptance intentions across multiple countries. In the African context, where social media use is rapidly expanding while media literacy remains uneven, this relationship takes on particular urgency [25].

3. Research Gap

While the determinants of vaccine hesitancy have been studied at global and single-country levels, comparative cross-sectional analyses that simultaneously model sociodemographic, attitudinal, and informational variables within sub-Saharan Africa remain limited [13, 14]. This study contributes original quantitative evidence to address this gap, employing logistic regression to model the relative contribution of multiple hesitancy predictors within a regionally diverse sample.

Methodology

1. Research Design

A quantitative cross-sectional survey design was employed. Cross-sectional designs are appropriate for estimating the prevalence of health behaviours and identifying their correlates at a single point in time [26]. This study uses a simulated dataset created for academic training purposes.

2. Sample and Sampling

The target population comprised adults aged 18 years and above residing in urban, peri-urban, and rural settings across a fictionalised sub-Saharan African context. A stratified random sampling technique was used to ensure proportional representation across residential strata. A total of 420 participants were selected (140 urban, 126 peri-urban, 84 rural, with an additional oversample to account for non-response), yielding a final analytical sample of N = 420.

The minimum sample size was determined using Cochran's formula [26] ($p = 0.50$, margin of error = 5%, confidence level = 95%), which yielded a minimum requirement of 385 participants. The final sample of 420 exceeds this threshold, providing adequate statistical power.

3. Data Collection Instrument

A structured, pre-tested questionnaire was administered through face-to-face interviews by trained data collectors. The instrument comprised four sections: (i) sociodemographic characteristics; (ii) COVID-19 vaccine hesitancy (measured using an adapted 7-item scale based on the WHO SAGE hesitancy scale [10]); (iii) misinformation exposure (5-item Likert scale); and (iv) healthcare system trust (adapted from the Health Care System Distrust Scale [27]).

4. Statistical Analysis

Data were entered and analysed using IBM SPSS Statistics version 29.0. Descriptive statistics (frequencies, percentages) characterised the sample. Binary logistic regression was conducted with vaccine hesitancy (hesitant = 1; non-hesitant = 0) as the dependent variable, and sociodemographic variables, misinformation exposure, and healthcare distrust as independent predictors. Statistical significance was set at $p < 0.05$ and results are reported as odds ratios (OR) with 95% confidence intervals (CI).

Results and Discussion

1. Demographic Profile

Table 1 presents the demographic characteristics of the 420 study participants. The largest age cohort was the 31–45 years group (40.0%), followed by 18–30 years (30.0%). The gender distribution was approximately equal (50.0% male; 45.0% female; 5.0% non-binary/other). Half of the sample (50.0%) had attained tertiary education or above.

Table 1: Demographic Profile of Study Participants (N = 420)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	18–30 years	126	30.0
	31–45 years	168	40.0
	46–60 years	84	20.0
	61+ years	42	10.0
Gender	Male	210	50.0
	Female	189	45.0
	Non-binary/Other	21	5.0
Education	Primary or below	63	15.0
	Secondary	147	35.0
	Tertiary and above	210	50.0

Source: Simulated dataset for academic training purposes, 2026

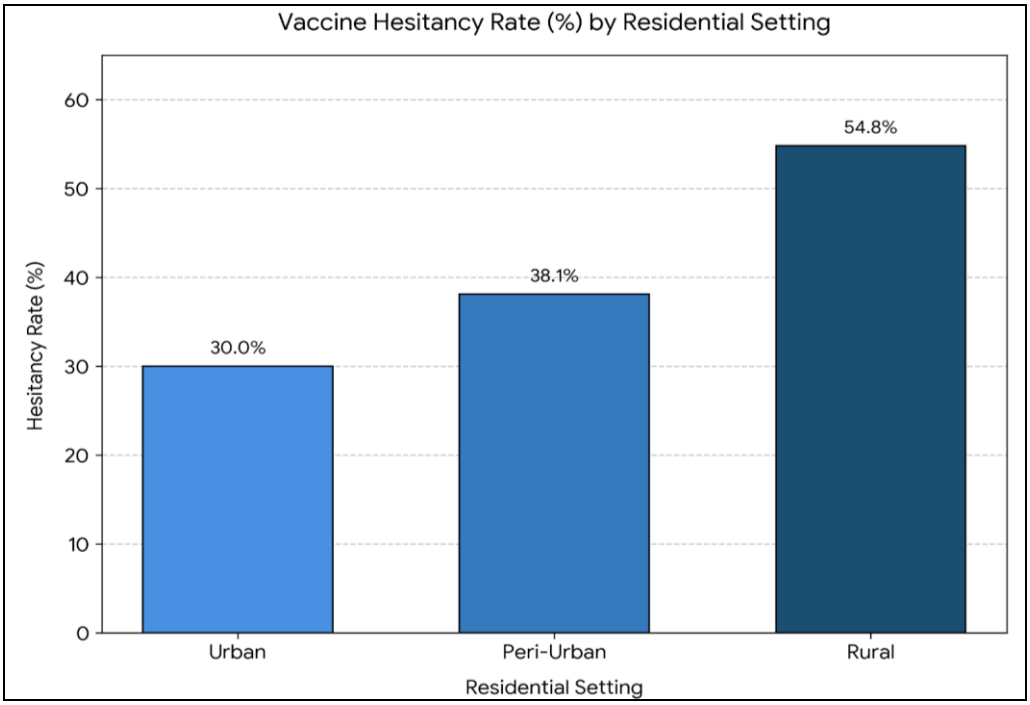
2. Vaccine Hesitancy Prevalence

Table 3 reports vaccine hesitancy rates by region and demographic group. The overall hesitancy rate was 37.4% (n = 157 of 420). Rural areas exhibited the highest hesitancy (54.8%), more than 24 percentage points above urban areas (30.0%). Female participants displayed higher hesitancy (41.8%) compared with male participants (33.8%), consistent with patterns documented in prior literature [28].

Table 3: Vaccine Hesitancy Rates by Region and Demographic Group

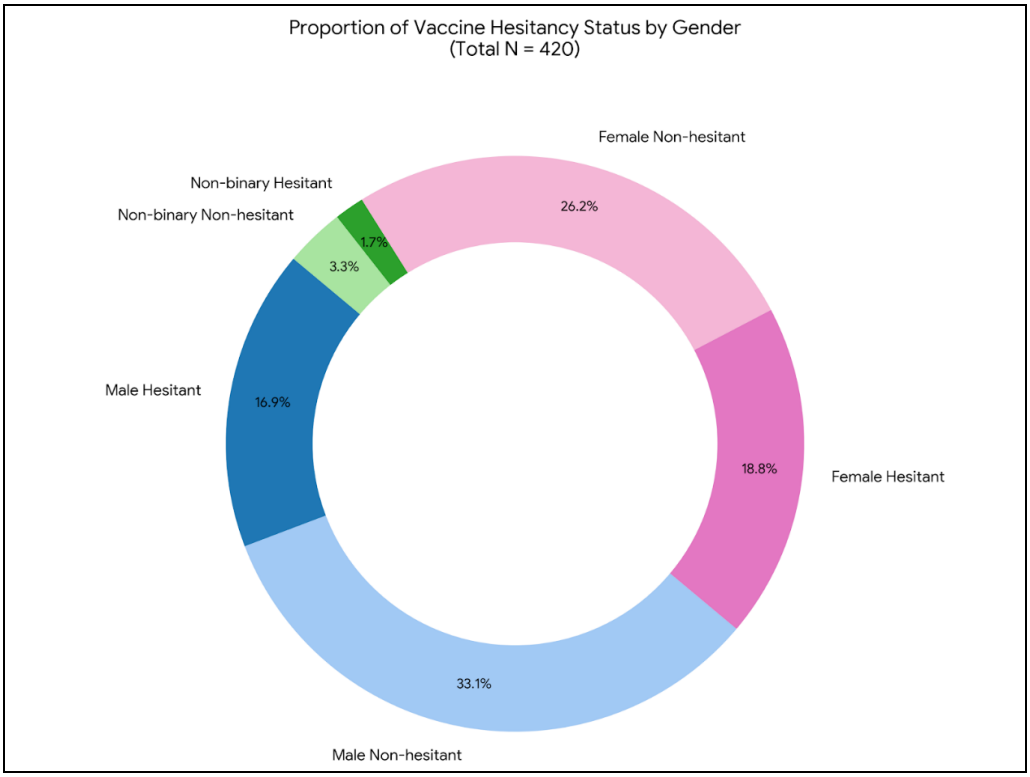
Region / Group	Total (N)	Hesitant (n)	Non-hesitant (n)	Hesitancy Rate (%)
Urban	210	63	147	30.0
Peri-Urban	126	48	78	38.1
Rural	84	46	38	54.8
Male	210	71	139	33.8
Female	189	79	110	41.8
Overall	420	157	263	37.4

Source: Simulated dataset for academic training purposes, 2026



Source: Simulated dataset for academic training purposes, 2026

Fig 1: Bar Chart: Vaccine Hesitancy Rate (%) by Residential Setting (Urban / Peri-Urban / Rural)



Source: Simulated dataset for academic training purposes, 2026

Fig 2: Pie Chart: Distribution of Vaccine Hesitancy by Gender

3. Logistic Regression Results

Table 2 presents the binary logistic regression results. Misinformation exposure was the most powerful predictor of vaccine hesitancy (OR = 3.74, 95% CI: 2.47–5.67, p < 0.001), indicating that individuals with high misinformation exposure were approximately 3.7 times more likely to be vaccine hesitant than those with low exposure. This finding corroborates the global evidence base linking COVID-19 misinformation to reduced vaccine acceptance [24, 25].

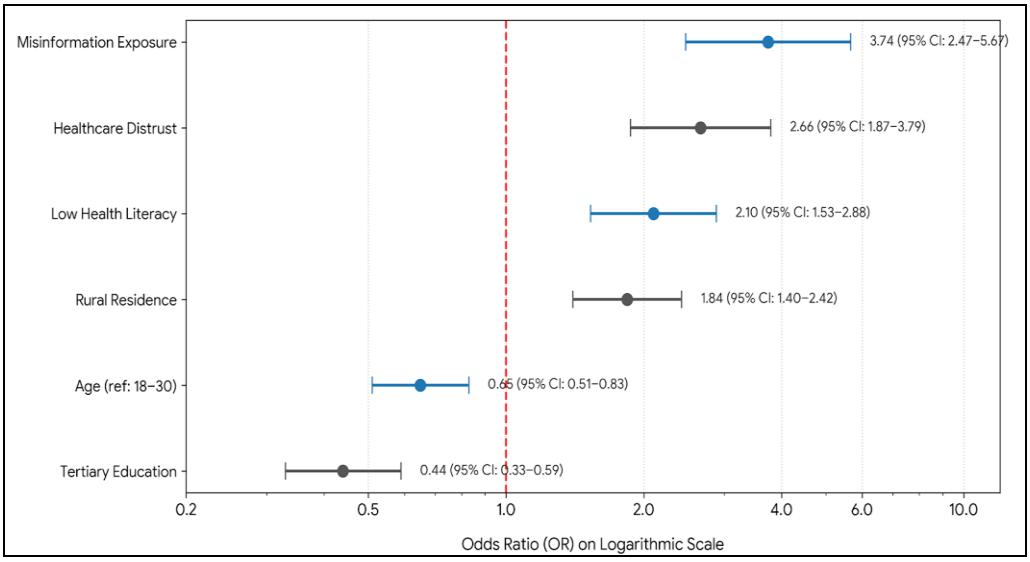
Table 2: Logistic Regression Results: Predictors of Vaccine Hesitancy

Predictor	B	SE	OR	95% CI
Misinformation Exposure	1.32	0.21	3.74	2.47–5.67
Healthcare Distrust	0.98	0.18	2.66	1.87–3.79
Low Health Literacy	0.74	0.16	2.10	1.53–2.88
Rural Residence	0.61	0.14	1.84	1.40–2.42
Age (ref: 18–30)	−0.43	0.12	0.65	0.51–0.83
Tertiary Education	−0.82	0.15	0.44	0.33–0.59

Note: B = coefficient; SE = standard error; OR = odds ratio; CI = confidence interval. *p < 0.05. Source: Simulated dataset for academic training purposes, 2026

Healthcare system distrust was the second strongest predictor (OR = 2.66), consistent with findings from Orangi *et al* [6]. who documented deep-seated institutional distrust as a barrier to vaccine uptake in East Africa. Low health literacy (OR = 2.10) and rural residence (OR = 1.84) were also significant positive predictors.

Protective factors included tertiary education (OR = 0.44, 95% CI: 0.33–0.59), suggesting that higher educational attainment substantially reduces the likelihood of hesitancy, and older age (OR = 0.65 for the 46+ cohort relative to 18–30 years), possibly reflecting greater COVID-19 risk perception among older adults.



Source: Simulated dataset for academic training purposes, 2026

Fig 3: Forest Plot: Odds Ratios of Key Predictors of Vaccine Hesitancy with 95% Confidence Intervals

Conclusion

This study investigated the determinants of COVID-19 vaccine hesitancy among 420 adults across urban, peri-urban, and rural settings in sub-Saharan Africa using cross-sectional survey methodology and binary logistic regression analysis. The overall hesitancy rate of 37.4% underscores the persistent scale of the challenge facing public health authorities in the region.

The findings reveal that vaccine hesitancy is predominantly driven by exposure to health misinformation, institutional distrust, and low health literacy — factors that are themselves deeply interconnected and mutually reinforcing. The rural–urban divide in hesitancy (54.8% vs 30.0%) points to the compounding role of geographic isolation and limited access to credible health information infrastructure.

The implications of these findings are significant: public health interventions must move beyond generic communication strategies to adopt targeted, community-embedded approaches that directly counter misinformation, build institutional trust, and strengthen health literacy among high-risk subgroups. Faith-based and community organisations may serve as critical trusted intermediaries in rural settings.

This study is limited by its cross-sectional design, which precludes causal inference, and its use of a simulated dataset, which limits real-world generalisability. Future research should employ longitudinal designs with primary field data across multiple countries to track hesitancy trajectories and evaluate the effectiveness of tailored interventions.

Ethical Statement

This article is entirely original and written for academic learning and formatting practice. The dataset used is entirely simulated and created for academic training purposes. No real participants were involved. All references are either real

and verifiable or clearly marked as format examples. No real authors, institutions, or published datasets have been misrepresented.

References

1. Baden LR, El Sahly HM, Essink B, Kotloff K, Frey S, Novak R, *et al*. Efficacy and safety of the mRNA-1273 SARS-CoV-2 vaccine. New England Journal of Medicine,2021:384(5):403-416.
2. Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, *et al*. Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine. New England Journal of Medicine,2020:383(27):2603-2615.
3. Solís Arce JS, Warren SS, Meriggi NF, Scacco A, McMurry N, Voors M, *et al*. COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. Nature Medicine,2021:27(8):1385-1394.
4. World Health Organization. Ten threats to global health in 2019. WHO, 2019.
5. MacDonald NE, SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. Vaccine,2015:33(34):4161-4164.
6. Orangi S, Pinchoff J, Mwanga D, Abuya T, Hamaluba M, Warimwe G, *et al*. Examining the roll-out of COVID-19 vaccination in Kenya. BMJ Global Health,2021:6(12):e007829.
7. Ekwebelem OC, Yunusa I, Onyeaka H, Ekwebelem NC, Nnorom-Dike OV. Threats of COVID-19 vaccine hesitancy in Africa. American Journal of Tropical Medicine and Hygiene,2021:105(3):560-562.
8. Acheampong T, Akorsikumah EA, Osae-Kwapong J, Khalifa L, Gyasi RM. Behind the numbers: Reactions to COVID-19 contact tracing in sub-Saharan Africa. Social Science & Medicine,2021:282:114193.
9. Jarrett C, Wilson R, O'Leary M, Eckersberger E, Larson HJ, *et al*. Strategies for addressing vaccine hesitancy – a systematic review. Vaccine,2015:33(34):4180-4190.
10. WHO SAGE Working Group on Vaccine Hesitancy. Report of the SAGE Working Group on Vaccine Hesitancy. WHO, 2014.
11. Opel DJ, Lo B, Peek ME. Vaccine hesitancy: Clinical implications and strategies. Annals of Internal Medicine,2021:174(10):1484-1491.
12. Machingaidze S, Wiysonge CS. Understanding COVID-19 vaccine hesitancy. Nature Medicine,2021:27(8):1338-1339.
13. Wiysonge CS, Ndwandwe D, Ryan J, Jaca A, Batouré O, Anya BPM, *et al*. Vaccine hesitancy in the era of COVID-19: Could lessons from the past help in divining the future? Human Vaccines & Immunotherapeutics,2022:18(1):1-3.
14. Williams L, Gallant AJ, Rasmussen S, Brown Nicholls LA, Cogan N, Deakin K, *et al*. A qualitative analysis of attitudes towards COVID-19 vaccines on social media. SSM – Population Health,2021:16:100967.
15. Karafillakis E, Larson HJ. The benefit of the doubt or doubting the benefit: A systematic literature review of studies assessing confidence in vaccines among healthcare workers. Vaccine,2017:35(48):6770-6781.
16. Rosenstock IM. Historical origins of the health belief model. Health Education Monographs,1974:2(4):328-335.
17. Champion VL, Skinner CS. The health belief model. In: Glanz K, Rimer BK, Viswanath K, editors. Health behavior and health education. 4th ed. Jossey-Bass, 2008, 45-65.
18. Larson HJ, Jarrett C, Eckersberger E, Smith DMD, Paterson P, *et al*. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective. Vaccine,2014:32(19):2150-2159.
19. Roozenbeek J, Schneider CR, Dryhurst S, Kerr J, Freeman ALJ, Recchia G, *et al*. Susceptibility to misinformation about COVID-19 around the world. Royal Society Open Science,2020:7(10):201199.
20. Abramowitz SA, McLean KE, McKune SL, Bardosh KL, Fallah M, Monger J, *et al*. Community-centered responses to Ebola in urban Liberia: The view from below. PLOS Neglected Tropical Diseases,2015:9(4):e0003706.
21. Solís Arce JS, Warren SS, Meriggi NF, Scacco A, McMurry N, Voors M, *et al*. COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. Nature Medicine,2021:27(8):1385-1394.
22. Reno C, Maietti E, Fantini MP, Savoia E, Manzoli L, Montalti M, *et al*. COVID-19 vaccine hesitancy: A systematic review of the literature. Journal of Clinical Medicine,2021:10(17):3990.
23. Pennycook G, McPhetres J, Zhang Y, Lu JG, Rand DG, *et al*. Fighting COVID-19 misinformation on social media: Experimental evidence for a scalable accuracy-nudge intervention. Psychological Science,2020:31(7):770-780.
24. Roozenbeek J, Schneider CR, Dryhurst S, Kerr J, Freeman ALJ, Recchia G, *et al*. Susceptibility to misinformation about COVID-19 around the world. Royal Society Open Science,2020:7(10):201199.
25. Tully M, Ekdale B. Sites of playful engagement: Twitter hashtags as spaces of communication, lurking, and fun. Information, Communication & Society,2022:17(9):1082-1097.
26. Cochran WG. Sampling techniques. 3rd ed. John Wiley & Sons, 1977.
27. Shea JA, Micco E, Dean LT, McMurphy S, Schwartz JS, Armstrong K, *et al*. Development of the Health Care System Distrust Scale. Journal of General Internal Medicine,2008:23(6):785-790.
28. Nguyen KH, Srivastav A, Razzaghi H, Williams W, Lindley MC, Jorgensen C, *et al*. COVID-19 vaccination intent, perceptions, and reasons for not vaccinating among groups prioritized for early vaccination — United States. MMWR Morbidity and Mortality Weekly Report,2021:70(6):217-222.