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Original Article

# Pattern of acceptability to yellow fever vaccination among skilled and unskilled workers in selected African countries

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## Abstract

Yellow fever still represents a major public health threat in Africa largely due to inadequate vaccine supply, insufficient vaccine coverage, increase in people without of vaccination living in endemic areas and occupation of individuals. The aim of this study was to assess the acceptability to yellow fever vaccination among skilled and unskilled workers in selected African countries. This cross sectional online survey was carried out between 19 January 2022 and 31 December 2022, in five African countries (Cameroon, Egypt, Nigeria, Sudan and the Gambia). The responses to the survey were collected by Survey Monkey and the links were distributed via Facebook, Twitter, and WhatsApp. Data were collected using self-administered structured questionnaire, and analysed. A total of 1340 respondents (601 skilled workers, 739 unskilled workers) participated in the survey of which 616 of them indicated had yellow fever vaccination. Proportion of the unskilled workers with history of vaccination was less than those of the skilled workers (35.5% vs 58.9%). Location (OR=31.04, $p$=0.000), age (OR=146.95, $p$=0.001), religion (OR=24.42, $p$=0.012), education (OR=116.41, $p$=0.001), marital status (OR=68.83, $p$=0.001) and monthly household income (OR=87.62, $p$=0.001) were significantly associated with acceptance to receive YF vaccine. In addition, more of the skilled workers were very willing to receive the YF vaccine compared to their unskilled counterparts ($p$<0.001). This study suggests that unskilled workers are less likely to be vaccinated against yellow fever than skilled workers, hence the need for strategic public health interventions to reach this category of people in the society.

**Keywords:** Acceptance, compliance, yellow fever, vaccination, unskilled labour

## Introduction

Yellow fever (YF) is an acute haemorrhagic illness caused by a flavivirus that is transmitted by mosquitos (Ferrara et al., 2021). It is endemic and occasionally pandemic in Africa and tropical South America, and it is carried by mosquito species such as *Aedes spp, Haemagogus spp*, and *Sabathes spp* (Garske et al., 2014). YF has a case fatality rate of 20% to 50% (WHO, 2013). Children under the age of nine months who lives or travels in an endemic region must be immunized since visitors to endemic regions are at danger of contracting the YF virus. The possibility of this hazard varies depending on the features of the passengers and their travels, such as

their targeted locations, itineraries, activities, trip length, season, and the pace at which the virus spreads in the target region (WHO, 2013).

Determining the severity of the disease may be challenging because YF produces such a broad variety of symptoms and majority of cases are difficult to identify. Furthermore, the majority of the impacted communities health care and monitoring systems are deficient. However, there is clearly much too little debate about YF. At the beginning of the 1990s, infection was considered to be the cause of 200,000 cases and 30,000 mortality annually (Garske et al., 2014). In Africa and Latin America, 45 endemic nations with a combined population of roughly one billion people and more than 500 million people are at danger in 32 African countries (Verma et al., 2014). YF has regained its prominence in Africa during the past 20 years and has become a significant public health problem and many Africans have experienced significant loss and despair as a result of the disease; this is one of the factors hindering Africa's economic and social progress (Tomori, 2002).

Despite significant advances in our understanding of how it spreads and the availability of a viable vaccine, YF remains a severe threat to public health (Simons & Patel, 2016). This might be due to ignorance or a lack of understanding, particularly among professionals, and this may be attributed to pattern of information or awareness especially among the skilled laborers who are mostly literate compare to unskilled or semi-skilled laborers. The severity of morbidity and mortality is generally underreported, and successive YF outbreaks and control attempts have disrupted health care delivery systems, depleted scarce internal resources, depleted donor money, and wasted a large number of immunization efforts.

Prompt detection of YF and rapid response through emergency vaccination campaigns are essential for controlling outbreaks (Jentes et al., 2011). It is estimated that the real number of cases is 10–250 times higher than what has been reported. According to the World Health Organization (WHO), every at-risk country should have at least one national laboratory where basic YF blood testing may be performed (WHO, 2013). Every confirmed case of YF should be thoroughly investigated since even one confirmed case in an uninfected neighbourhood should be considered an outbreak (particularly in any area where most of the population has been vaccinated).

There has been a lot of information about vaccine acceptance among health care workers (Akodu et al., 2019; Peterson et al., 2022; Shekhar et al., 2021), but there is less information on the pattern of acceptability of vaccine among skilled and unskilled labourer in both developed and developing countries. Occupations of individuals may also be increased risk of exposure to YF due to the high population density of their workplace environment, such as public places and commercial service staff, blue-collar workers in labour-intensive enterprises. The aim of this study was to assess the acceptance to YF vaccination among skilled and unskilled workers in African countries.

## Methods

A web-based online survey was conducted between 19 January 2022 to 31 December, 2022 in selected five African countries (Cameroon, Egypt, Nigeria, Sudan and Gambia). The survey was hosted by SurveyMonkey via the use of Facebook, Twitter, and WhatsApp. The survey was divided into different sections. In the initial part of the introduction and a page informed consent. The following sections were only open to those who were willing to participate consisted of section where demographics of the participants, their thoughts on vaccinations, occupational status of the participants, awareness of the respondents on YF, willingness of the participants to YF vaccine uptake, pattern of vaccination uptake among the participants and vaccination history were assessed.

The response variable in this study was acceptance of vaccination (how respondents felt about vaccines and vaccination assessments) and for each question about acceptance of vaccination one point was given for a correct answer and zero point for a poor incorrect answer. The result was a total score. The median score was then chosen. People were assessed to have poor acceptance of vaccinations if their overall score was similar to or lower than the median, whereas people who scored higher than the median were judged to have high acceptance. The survey was completed around ten to fifteen minutes to complete.

After the data was collected, the responses were examined to ensure they were complete and usable. In accordance with the study objectives, the data were quantitatively evaluated. When respondents were asked closed-ended questions with a limited number of permissible responses, quantitative analysis was applied. All of the derived frequency distributions, percentages, mean scores, standard deviations, and charts were presented into a table. Chi-squared was employed to determine the factor associated with acceptance of vaccination. The level of significance was set at $p<0.05$. IBM Statistical Packages for the Social Sciences (SPSS), version 25, was used to analyse the data.

## Results

A total of 1340 respondents included in the analysis and the characteristics are presented in Table 1. There were 778 (58.1%) of the participants were female and around half of the participants were between 21–30 years (51.2%). Based on religion, majority of them were Christians (66.2%), and then followed by Muslims (32.7%). Majority of the respondents had secondary education (54.4%), followed by those with tertiary education (44.9%). Majority of the respondents shows were unskilled workers (55.1%), while others were skilled workers (44.9%) (Table 1).

Table 1. Socio demographic characteristics of the participants (n=1340)

| Variable | Categories | Frequency | Percentage |
|---|---|---|---|
| Gender | Female | 778 | 58.1 |
| | Male | 562 | 41.9 |
| Age group (year) | <20 | 154 | 11.5 |
| | >51 | 67 | 5.0 |
| | 21–30 | 686 | 51.2 |
| | 31–40 | 278 | 20.7 |
| | 41–50 | 155 | 11.6 |
| Religion | Christianity | 887 | 66.2 |
| | Evangelical | 7 | 0.5 |
| | Islam | 438 | 32.7 |
| | Others | 4 | 0.3 |
| | Traditional | 4 | 0.3 |
| Educational status | None | 10 | 0.7 |
| | Secondary | 729 | 54.4 |
| | Tertiary | 601 | 44.9 |
| Marital status | Divorced | 27 | 2.0 |
| | Married | 425 | 31.7 |
| | Separated | 5 | 0.4 |
| | Single | 883 | 65.9 |
| Occupation | Unskilled worker | 739 | 55.1 |
| | Skilled worker | 601 | 44.9 |

Majority of them have heard of YF before (95.6%), and indicated virus (68.3%), monkeys (65.2%) and mosquito (72.6%), as the aetiology, reservoir host and insect vector of YF, respectively (Table 2). Still, majority of the respondents were willing to receive YF vaccine (52.4%), followed by those who were very willing (31.8%) and then, those not willing (15.8%) (Table 2).

Table 2. Comparation of awareness on yellow fever (YF) between unskilled and skilled workers

| Variable | Categories | Unskilled workers n (%) | Skilled workers n (%) | Total n (%) | *p*-value |
|---|---|---|---|---|---|
| Have you heard of YF before | No | 49 (3.7) | 10 (0.7) | 59 (4.4) | 0.000* |
| | Yes | 690 (51.5) | 591 (44.1) | 1281 (95.6) | |
| Causes of YF | Bacteria | 35 (2.6) | 23 (1.7) | 58 (4.3) | 0.000* |
| | No Idea | 76 (5.7) | 50 (3.7) | 126 (9.4) | |
| | Parasite | 158 (11.8) | 83 (6.2) | 241 (18.0) | |
| | Virus | 470 (35.1) | 445 (33.2) | 915 (68.3) | |
| Reservoir host of YF virus | Cattle | 90 (6.7) | 68 (5.1) | 158 (11.8) | 0.003* |
| | Dogs | 39 (2.9) | 9 (0.7) | 48 (3.6) | |
| | Monkeys | 477 (35.6) | 397 (29.6) | 874 (65.2) | |
| | Pigs | 25 (1.9) | 19 (1.4) | 44 (3.3) | |
| | Wild birds | 108 (8.1) | 108 (8.1) | 216 (16.1) | |
| Insect vector for yellow fever | House fly | 68 (5.1) | 73 (5.4) | 141 (10.5) | 0.000* |
| | Mosquito | 566 (42.2) | 407 (30.4) | 973 (72.6) | |
| | No idea | 48 (3.6) | 78 (5.8) | 126 (9.4) | |
| | Sand fly | 57 (4.3) | 43 (3.2) | 100 (7.5) | |

* Statistically significant at $p$=0.05

The associations between socio demographic and acceptance to receive YF vaccine are presented in Table 3. Location (OR=31.04, $p$=0.000), age (OR=146.95, $p$=0.001), religion (OR=24.42, $p$=0.012), education (OR=116.41, $p$=0.001), marital status (OR=68.83, $p$=0.001) and monthly household income (OR=87.62, $p$=0.001) were significantly associated with acceptance to receive YF vaccine (Table 3).

Table 3. Association between socio demographic and acceptance to receive yellow fever (YF) vaccine (n=1340)

| Variable | Categories | Not willing n (%) | Willing n (%) | Very willing n (%) | OR | *p*-value |
|---|---|---|---|---|---|---|
| Acceptance | | 212 (15.8) | 702 (52.4) | 426 (31.8) | | |
| Country | Cameroon | 48 (3.6) | 156 (11.6) | 96 (7.2) | 1.45 | 0.994 |
| | Egypt | 19 (1.4) | 63 (4.7) | 42 (3.1) | | |
| | Nigeria | 90 (6.7) | 305 (22.8) | 185 (13.8) | | |
| | Sudan | 26 (1.9) | 82 (6.1) | 42 (3.1) | | |
| | Gambia | 29 (2.2) | 96(7.2) | 61 (4.6) | | |
| Nature of location | Rural | 35 (2.6) | 100 (7.5) | 39 (2.9) | 31.04 | <0.001* |
| | Sub-urban | 33 (2.5) | 184 (13.7) | 73 (5.4) | | |
| | Urban | 144 (10.7) | 418 (31.2) | 314 (23.4) | | |
| Gender | Female | 131 (9.8) | 415 (31.0) | 232 (17.3) | 3.79 | 0.149 |
| | Male | 81 (6.0) | 287 (21.4) | 194 (14.5) | | |
| Age group (year) | <20 | 57 (4.3) | 79 (5.9) | 18 (1.3) | 146.95 | <0.001* |
| | >51 | 0 (0) | 57 (4.3) | 10 (0.7) | | |
| | 21–30 | 101 (7.5) | 385 (28.7) | 200 (14.9) | | |
| | 31–40 | 44 (3.3) | 113 (8.4) | 121 (9.0) | | |
| | 41–50 | 10 (0.7) | 68 (5.1) | 77 (5.7) | | |
| Religion | Christianity | 140 (10.4) | 471 (35.1) | 276 (20.6) | 24.42 | 0.012* |
| | Evangelical | 0 (0) | 7 (0.5) | 0 (0) | | |
| | Islam | 72 (5.4) | 220 (16.4) | 146 (10.9) | | |
| | Others | 0 (0) | 0 (0) | 4 (0.3) | | |
| | Traditional | 0 (0) | 4 (0.3) | 0 (0) | | |
| Educational status | None | 10 (0.7) | 0 (0) | 0 (0) | 116.41 | <0.001* |
| | Secondary | 157 (11.7) | 397 (29.6) | 175 (13.1) | | |
| | Tertiary | 45 (3.4) | 305 (22.8) | 251 (18.7) | | |
| Marital status | Divorced | 5 (0.4) | 5 (0.4) | 17 (1.3) | 68.83 | <0.001* |
| | Married | 30 (2.2) | 228 (17.0) | 167 (12.5) | | |
| | Separated | 0 (0) | 5 (0.4) | 0(0) | | |
| | Single | 177 (13.2) | 464 (34.6) | 242 (18.1) | | |
| Monthly household income (USD): | <$500 | 69 (5.1) | 245 (18.3) | 204 (15.2) | 87.62 | <0.001* |
| | ≥$6000 | 10 (0.7) | 15 (1.1) | 0 (0) | | |
| | $1000 - $1999 | 23 (1.7) | 55 (4.1) | 39 (2.9) | | |
| | $2000 - $2999 | 5 (0.4) | 28 (2.1) | 10 (0.7) | | |

| Variable | Categories | Not willing n (%) | Willing n (%) | Very willing n (%) | OR | *p*-value |
|---|---|---|---|---|---|---|
| Acceptance | | 212 (15.8) | 702 (52.4) | 426 (31.8) | | |
| | $3000 - $3999 | 0 (0) | 15 (1.1) | 12 (0.9) | | |
| | $4000 - $4999 | 0 (0) | 15 (1.1) | 5 (0.4) | | |
| | $500 - $999 | 20 (1.5) | 92 (6.9) | 63 (4.7) | | |
| | $5000 - $5999 | 0 (0) | 5 (0.4) | 0 (0) | | |
| | No income | 85 (6.3) | 232 (17.3) | 93 (6.9) | | |

* Statistically significant at $p$=0.05

The pattern of vaccination uptake among the participants is presented in Table 4. More of the skilled workers were very willing to receive the YF vaccine compared to their unskilled counterparts (18.7% vs 13.1%). There were more unskilled workers not willing to receive the YF vaccine compared to their skilled counterparts (12.5% vs 3.4%). There was a significant associating between status of the occupation with acceptance of YF vaccine ($p$<0.001). In addition, there were more unskilled workers (19.5% and 23.5%), compared to their skilled counterparts (16.0% and 20.9%) who indicated that the health authority of their countries are not doing well enough to control YF through vaccination.

Table 4. Pattern of yellow fever (YF) vaccination uptake among the participants

| Variable | Categories | Unskilled workers n (%) | Skilled workers n (%) | Total n (%) | OR | *p*-value |
|---|---|---|---|---|---|---|
| How willing are you to receive YF vaccine | Not willing | 167 (12.5) | 45 (3.4) | 212 (15.8) | 86.19 | <0.001* |
| | Very willing | 175 (13.1) | 251 (18.7) | 426 (31.8) | | |
| | Willing | 397 (29.6) | 305 (22.8) | 702 (52.4) | | |
| Do you think the health authority of your country is doing well enough to control YF through vaccination | No | 261 (19.5) | 215 (16.0) | 476 (35.5) | 37.12 | <0.001* |
| | No idea | 280 (20.9) | 146 (10.9) | 426 (31.8) | | |
| | Yes | 198 (14.8) | 240 (17.9) | 438 (32.7) | | |

* Statistically significant at $p$=0.05

## Discussion

This online survey provides important data on YF vaccine acceptance on YF vaccination among skilled and unskilled workers in selected African countries. In this study, it was observed that more unskilled workers (55.1%) consisting of crop farmers, artisans and traders participated in the online survey compared to their skilled counterparts (44.9%) who were predominantly civil servants. The pattern of occupation of the respondents vary based on geographical location of individual, however since most of the participants were from developing region, they were most likely to engage in skilled, semi-skilled or unskilled labour.

In this study, 95.6% of the participants were aware of YF. These findings might be attributed to a more efficient monitoring system and increased global knowledge of the YF (Nwaiwu et al., 2021). A study demonstrated that the high prevalence of YF in Africa is due to a confluence of economic, demographic, and environmental variables (Kwagonza et al., 2018). Another study revealed that many community members believed that most instances of fever are due to malaria and the community had a low level of awareness about other non-malarial febrile illnesses like Rift Valley fever and dengue fever despite the endemicity of the diseases (Legesse et al., 2018).

The main characteristics of the study population according to vaccine acceptance or hesitancy were assessed among study participants. In this study more than two-third of the respondents were willing to accept YF vaccine. Findings by a previous study reported poor risk perception and vaccination hesitancy (Jentes et al., 2013).

A study reported adverse effects are common (Ferrara et al., 2021) making elder travellers may be hesitant to get the YF vaccination for this safety concern. Those who seek medical advice before travelling, on the other hand, are more likely to trust the medical community and experts. A study reported that vaccine acceptability among high-risk occupations was unsatisfactory before the stage of emergency vaccination, because the natural occurrence of the disease also can fluctuate, being absent in certain areas for years before reappearing (Sun et al., 2022). Delineation of affected areas depends on surveillance for animal reservoirs and vectors, accurate diagnosis, and prompt reporting of all human cases vary.

A study also reported that visit friends and relatives travellers who did seek pre-travel care were approximately three times more likely to decline YF vaccination than those travellers who were traveling for non-visit friends and relatives/non-leisure purposes (Jentes et al., 2013). The finding that visit friends and relatives are more likely to decline vaccination underscores the need for both primary healthcare and travel medicine providers to identify these persons before they embark on international travel and thoroughly discuss the risk and benefits of vaccination.

Furthermore, it was estimated that the risk of YF illness in travellers to West Africa for a 2-week trip was 1:2,000 during inter-epidemic periods and 1:267 during epidemic periods, although the risks might vary according to the season (Monath, 2012; Monath & Cetron, 2002). Since passive surveillance systems are often insensitive in identifying cases, the true number of cases is unknown. The paucity of reported YF cases in such countries might falsely reassure travellers, specifically visiting friends and relatives (VFR) travellers who are still at risk for contracting YF disease if they have never been immunized. Therefore vaccination of YF needs to be promoted in the African countries.

## Conclusion

Our data suggested that unskilled workers were less likely to be vaccinated against YF than their skilled counterparts, hence the need for strategic public health interventions to reach this category of people in the society. Information on the aetiology and vector of YF, mode of transmission, as well as measures for prevention and control (particularly vaccination) must be readily made available through the help of community health extension workers and community leaders (religious and traditional).

## Authors' contributions

Study Concept And Design: S.S.E., A.R.Y., E.D.E.; Acquisition Of Data: S.S.E., K.S.A., R.R.H.E., S.U., T.M.C.L., Sse., A.R.Y., E.D.E., E.N.A., Sta., D.A.E., Ige., Oeo., E.E.J., G.D.S., E.O.U., A.O.O., I.E.O.; Analysis And Interpretation Of Data: S.S.E., A.O.O., A.R.Y., E.D.E., D.A.E., I.G.E., O.E.O., E.E.J.; Drafting Of The Manuscript: S.S.E., A.R.Y.; Critical Revision Of The Manuscript For Important Intellectual Content: S.S.E., A.R.Y., E.D.E., E.N.A., K.S.A., R.R.H.E; Statistical Analysis: A.O.O, S.T.A.; Study Supervision: S.S.E., A.R.Y., I.G.E.

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## Ethical Approval

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## Conflict of interests

The authors declare no conflict of interests.

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