COVID-19 Infodemiology in Nigeria- Predictors of Sources and Perceived accuracy: An online cross-sectional study

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Submitted to: JMIR Public Health and Surveillance
on: July 08, 2020

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Abstract

Background: Effective communication is critical in mitigating the public health risks associated with the COVID-19 pandemic.

Objective: This study assesses the source(s) of COVID-19 Information among Nigerians, predictors and the perceived accuracy of information from these sources.

Methods: We conducted an online survey on consenting adults residing in Nigeria between April and May 2020 during the lockdown and first wave of COVID-19. The major sources of information about COVID-19 were distilled from seven potential sources (family or friends; place of worship; health care providers; internet; work-place; traditional media and public posters/ banners). An open-ended question was asked to explore how respondents determined the accuracy of information. Statistical analysis was done using STATA 15.0 software (StataCorp Texas) with significance placed at p-value <0.05. Approval was obtained for the conduct of this study from the Lagos State University Teaching Hospital Ethical Committee.

Results: A total of 719 respondents completed the survey. Most of the respondents (89.3%) obtained COVID-19 related information from the internet. About 85.8% considered their source(s) of information as accurate; and 32.6% depended on only one out of the seven potential sources of COVID-19 information. Respondents earning a monthly income between NGN 70,000-120,000 had lower odds of obtaining COVID-19 information from the internet compared to respondents earning less than NGN 20,000 (OR: 0.49; 95% CI: 0.24,0.98; p: 0.04). Also, a significant proportion of respondents sought accurate information from recognized health organisations, such as, the Nigeria Centre for Disease Control (NCDC) and the World Health Organisation (WHO).

Conclusions: The internet was the most common source of COVID-19 information, and the population sampled had a relatively high level of perceived accuracy for the COVID-19 information received. Effective communication requires dissemination of information via credible communication channels, as identified from this study. This is potentially beneficial for risk communication in the control of the COVID-19 pandemic. Clinical Trial: NA

(JMIR Preprints 08/07/2020:22273)
DOI: https://doi.org/10.2196/preprints.22273

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TITLE: COVID-19 Infodemiology in Nigeria- Predictors of Sources and Perceived accuracy: An online cross-sectional study

Introduction

The coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first identified in Wuhan, Hubei, China in December 2019 [1], and thereafter was recognised as a pandemic by the World Health Organization (WHO) on 11 March 2020 [2]. As of 6th of July 2020, more than 11 million cases of and 537,419 deaths from COVID-19 have been reported in 213 countries [3]. In Africa, over 470,000 cases have been recorded with more than 29,000 cases from Nigeria [3]. The virus is typically spread from one person to another via respiratory droplets and contact with contaminated surfaces [4].

COVID-19 has led to unprecedented local and global public health measures, such as obligatory movement restrictions, social and physical distancing, prolonged closures of schools, and leisure centres. Guidelines have emerged in Nigeria from State health agencies, the Nigeria Centre for Disease Control, and the Federal Ministry of Health on risk factors and preventive measures during the COVID-19 outbreak [5]. As the understanding of SARS-CoV-2 virus increases, local COVID-19 interventions are beginning to focus on the sources and perceived accuracy of disseminated preventive information which portends an important process in the prevention and control of the disease [6].

Potential sources of information during disease outbreaks include the internet with social media platforms such as WhatsApp, twitter, Instagram, Facebook, the traditional media (television, radio and newspapers), places of worship, health care providers, friends, family members, and work-places. Therefore, due to the varied sources of information on COVID-19, identifying factors related to such information sources can support public educational interventions [7].

In a survey conducted among a Nigerian population during the Ebola Virus Disease (EVD) outbreak in 2014 [8], the majority of respondents depended on traditional media as sources of information on the disease, while less than one-third depended on the internet for their information. This evidence may suggest that perception and trust of information source are intertwined and contribute to use [8].

As the Nigerian government has begun easing COVID-19 lock-down measures, effective communication is an essential component in mitigating the risks associated with the inevitable clustering of people in public places and other practices capable of not only fueling the spread of the disease, but spiking the number of cases and mortality from COVID-19 [9]. Therefore, effectively communicating the efficacy of practical interventions such as personal hygiene, hand washing, use of face masks and social distancing among other strategies may help curb transmission. Consequently, identifying common sources of COVID-19 information among the population, and the perceived accuracy of these information-sources, will possibly guide risk-communication processes and dissemination of evidence-based COVID-19 public health information. The dissemination of this information can be channelled to the most commonly used sources, with the highest levels of perceived accuracy.

This study aims to identify the sources of COVID-19 Information among Nigerians, predictors and the perceived accuracy of these sources. Findings from this study will support policymakers in disseminating targeted evidence-based anti-COVID-19 information to populations at risk and those affected. This can invariably empower the public with the capacity to make informed health decisions and improve health outcomes.

Methodology

This study is part of the online survey descriptive cross-sectional survey on COVID-19 conducted by the Lagos State University College of Medicine (hereafter referred to as the LASUCOM COVID-19 survey) between April 22nd and May 20th 2020. The LASUCOM survey was conducted to assess psychological distress, adherence, and sources of information during the COVID-19 outbreak.

Study Design and population: Study participants were consenting individuals aged 18 years or above, residing in Nigeria at the time of the study. A multistage sampling technique was used in selecting study participants. Firstly, three states were purposively selected from the 36 states in Nigeria because at the time of study design, they accounted for the highest number of COVID 19 cases in Nigeria [10]. Subsequently, a sample frame of local community networks (estate associations, local organizations, schools and religious organization groups) within Lagos State, Ogun State and Federal Capital Territory Abuja (FCT) was obtained by the Research Office of Lagos State Ministry of Health (LSMoH) using country-wide partners. A list of networks was selected using a simple random sampling method. Leaders of these community networks were identified by the LSMoH research office and contacted via phone calls and email. Permission was obtained from leaders of the community networks before the online survey link was shared with all members of their respective groups. Nine leaders were approached and seven provided consent to share the link to the survey via email and on the social media handle (WhatsApp and twitter) of their groups. Subsequently, consenting participants on these groups indicated individual consent by clicking a button: I consent, on the first page of the online form before proceeding to answer the survey questions. This data collection approach was due to the movement restrictions and social/ physical distancing measures enforced by the Federal government of Nigeria to curb the spread of COVID-19.

Assessment tools: Data collection was conducted online using an online survey tool SurveyMonkey Inc (San Mateo, California, USA). Completing the online survey took an average of seven minutes.

Study measures:

Sociodemographic variables: Information was obtained on the sex (male or female) of respondents, age, marital status, education, and income levels (in naira- NGN). Marital status was grouped as single, married; and ever married (widow/widower/divorced/ separated). Educational level of respondents was categorized in three groups: high school or less; university or polytechnic; and postgraduate education. Income level was categorized into three groups: less than NGN 20,000 [$52]; NGN 20,000-70,000 [$52-$181]; NGN 70,000-120,000 [$181-$310]; and above NGN 120,000 [>$310].

Sources of COVID-19 Information: The study categorized COVID-19 information sources into broad groups: 1) Family members or friends; 2) Place of worship; 3) Health Care providers (Doctors/ Nurses/Pharmacists); 4) The internet category, as comprising three broad groups: a. social media [Facebook/WhatsApp/Instagram/twitter], b. News websites, c. non-news non-social media websites [example, blogs, websites for health regulatory organisations- WHO, NCDC]; 5) Work-place; 6) Traditional media (Television or Radio or Newspapers) and 7) Public posters and banners. The sum-total of sources of COVID-19 information was determined for each respondent.

Perceived accuracy of Source(s) of COVID-19 information*:* The perceived accuracy of COVID-19 information was assessed by asking the question “Do you think your source of information is accurate”, to which respondents were given the response options: Yes or No or I don’t know. An open-ended question asking “How do you differentiate between accurate and inaccurate COVID-19 information” was used to explore how respondents determined the accuracy of COVID-19 information (Survey questions in Appendix I).

Statistical analysis: Online responses from the survey tool were automatically converted to variables on a Microsoft Excel sheet. Demographic data, source(s), perceived accuracy, and sum-total number of COVID-19 information sources were expressed using descriptive statistics. The association between socio-demographic variables, source(s), perceived accuracy, and sum-total number of

COVID-19 information sources were investigated using bivariate and multivariate logistic regression analysis. Multiple linear regressions were also used to assess the association between the total number of sources of information sources and factors related to COVID-19 information (age, sex, marital status, education, income and perceived accuracy). p values <0.05 were considered significant, and tests were 2- tailed. Statistical analysis was done using STATA 15.0 software (StataCorp LLC Lakeway Drive, College Station, Texas). Qualitative analysis using R (R Core team, 2017) was used to explore themes and subthemes explaining the determinants of perceived accuracy of COVID-19 information.

Ethics: Ethical approval was obtained from the Health Research Ethics Committee of the Lagos State University Teaching Hospital with number LREC/06/10/1347.

Results

A total of 719 respondents completed the online survey (94.1% response rate), while 45 respondents were excluded due to incomplete responses. The mean age of respondents was 26.9 years (SD:8.8; range: 15-69 years). Respondents aged less than 35 years accounted for 88%, while females made up 54% of all study participants. The majority of respondents were single, with University/ Polytechnic education, and a monthly income of less than NGN 20,000 [Table 1].

Sources of COVID-19 Information

The sources of COVID-19 Information among respondents ranged from family and friends to public posters and banners. The most common source of information was the internet (n=642; 89.3% of total respondents), which comprised news on social media handles, websites, blogs, and social media. This was followed by traditional media comprising of television, radio, and newspaper/ print media reported by 62.9% (n=452) of all respondents. The least common source of information were places of worship (n=86; 12.0%). Out of a total of seven options in the survey, most respondents

used only one source of information (n=234; 32.6%) [Table 1]. Sociodemographic characteristics of respondents using each source of COVID-19 information is illustrated in Table A [Appendix 1].

Table 1. Sociodemographic factors and Sources of Information

Variable	n (%)
Age [in years]	
<35	633 (88.0)
≥35	86 (12.0)
Sex	
Male	329 (45.8)
Female	390 (54.2)
Marital status	
Single	571 (79.4)
Married	141 (19.6)
Ever married	7 (1.0)
Education	
Secondary school or less	75 (10.4)
University/ Polytechnic	516 (71.8)
Postgraduate	128 (17.8))
Income [in NGN]	
<20,000	288 (40.1)
20,000-70,000	214 (29.8)
>70,000-120,000	86 (11.9)
>120,000	131 (18.2)
Sources of Information	
Family and Friends	269/719 (37.4)
Place of worship	86/719 (12.0)
Health care provider	210/719 (29.2)
Internet	642/719 (89.3)
Work-place	90/719 (12.5)
Traditional media	452/719 (62.9)
Public posters and banners	89/719 (12.4)
Sum of Sources of Information	
1	234 (32.6)
2	149 (20.7)
3	172 (23.9)
4	88 (12.2)
5	37 (5.2)
6	20 (2.8)
7	19 (2.6)
Perceived accuracy of information	
No	102 (14.2)
Yes	617 (85.8)

Table 2. Sociodemographic factors related to sources of COVID-19 information

Variables	Family and Friends	p value	Place of worship	p value	Health care provider	p value	Internet	p value	Work-place	p value	Traditional media	p value	Public posters and banners	p value
	OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)	
Age	0.98 (0.96,1.00)	0.06	1.01 (0.99,1.03)	0.43	0.99 (0.97,1.01)	0.19	0.99 (0.96,1.01)	0.33	1.04 (1.02,1.06)	0.00*	1.02 (1.00,1.04)	0.03*	1.0 (0.97,1.02)	0.80
Sex														
Male	1		1		1		1		1		1		1	
Female	1.31 (0.96,1.77)	0.09	0.92 (0.58,1.44)	0.71	0.81 (0.59,1.11)	0.19	0.83 (0.51,1.33)	0.43	0.67 (0.43,1.05)	0.08	0.82 (0.61,1.11)	0.21	0.56 (0.36,0.88)	0.01*
[a] Marital Status														
Single	1		1		1		1		1		1		1	
Married	0.66 (0.44,0.98)	0.04*	0.92 (0.51,1.63)	0.77	0.60 (0.38,0.93)	0.02*	0.60 (0.35,1.03)	0.06	1.91 (1.16,3.13)	0.01*	1.80 (1.20,2.71)	0.01*	0.80 (0.44,1.44)	0.46
Educational														
≤High school	1		1		1		1		1		1		1	
University	0.82 (0.50,1.33)	0.42	1.10 (0.50,2.40)	0.81	0.48 (0.29,0.79)	0.00*	0.70 (0.29,1.69)	0.43	3.10 (0.95,10.14)	0.06	1.07 (0.65,1.76)	0.79	1.95 (0.76,5.01)	0.17
Postgraduate	0.66 (0.36,1.18)	0.16	1.37 (0.56,3.33)	0.49	0.50 (0.27,0.90)	0.02*	0.71 (0.26,1.93)	0.5	6.72 (1.97,22.96)	0.00*	1.52 (0.84,2.76)	0.17	2.75 (0.99,7.63)	0.05
Income														
<NGN 20,000	1		1		1		1		1		1		1	
NGN 20,000-70,000	0.97 (0.67,1.39)	0.86	1.11 (0.64,1.92)	0.72	1.31 (0.89,1.95)	0.17	0.72 (0.40,1.29)	0.27	2.85 (1.25,6.47)	0.01*	0.99 (0.68,1.42)	0.94	1.16 (0.67,1.99)	0.61
NGN70,000-120,000	0.86 (0.52,1.42)	0.56	0.71 (0.30,1.67)	0.43	1.75 (1.05,2.91)	0.03*	0.49 (0.24,0.98)	0.04*	7.64 (3.26,17.87)	0.00*	0.96 (0.59,1.58)	0.88	1.05 (0.49,2.24)	0.89
>NGN 120,0000	0.70 (0.45,1.08)	0.10	1.53 (0.85,2.77)	0.16	1.25 (0.79,1.98)	0.34	0.86 (0.43,1.75)	0.68	16.78 (7.89,35.68)	0.00*	1.15 (0.74,1.77)	0.54	1.44 (0.79,2.63)	0.23
**Accuracy														
Inaccurate	1		1		1		1		1		1		1	
Accurate	0.76 (0.49,1.16)	0.20	1.02 (0.53,1.96)	0.95	1.59 (0.96,2.63)	0.07	0.89 (0.44,1.80)	0.75	1.21 (0.62,2.37)	0.57	1.28 (0.84,1.96)	0.26	0.72 (0.40,1.30)	0.28

* p value <0.05. [a] Ever married was excluded because it had only 7 respondents. **Accuracy: for the purpose of this study synonymous with Perceived accuracy of information

Table 3. Multiple logistic regression analysis of factors related to sources of COVID-19 information

Variables	Family and Friends	p value	Place of worship	p value	Health care provider	p value	Internet	p value	Work-place	p value	Traditional media	p value	Public posters and banners	p value
	aOR (95% CI)		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)	
Age	1.00 (0.97,1.02)	0.84	1.02 (0.98,1.06)	0.34	0.99 (0.96,1.02)	0.67	1.00 (0.97,1.04)	0.80	1.00 (0.97,1.04)	0.83	1.00 (0.98,1.03)	0.76	0.98 (0.94,1.02)	0.35
Sex														
Male	1		1		1		1		1		1		1	
Female	1.29 (0.94,1.78)	0.11	1.02 (0.64,1.62)	0.94	0.84 (0.60,1.18)	0.31	0.88 (0.53,1.45)	0.61	0.94 (0.57,1.54)	0.81	0.79 (0.58,1.09)	0.15	0.55 (0.34,0.88)	0.01*
Marital Status														
Single	1		1		1		1		1		1		1	
Married	0.71 (0.41,1.24)	0.23	0.55 (0.23,1.31)	0.18	0.53 (0.28,0.98)	0.04*	0.51 (0.24,1.09)	0.08	0.59 (0.28,1.25)	0.17	1.83 (1.04,3.25)	0.04*	0.68 (0.29,1.56)	0.36
Educational														
≤High school	1		1		1		1		1		1		1	
University	0.84 (0.51,1.39)	0.50	1.10 (0.50,2.44)	0.81	0.48 (0.29,0.80)	0.01*	0.74 (0.30,1.82)	0.51	2.13 (0.62,7.30)	0.23	1.05 (0.63,1.74)	0.87	2.30 (0.88,6.03)	0.09
Postgraduate	0.85 (0.43,1.67)	0.64	1.28 (0.46,3.53)	0.63	0.55 (0.27,1.10)	0.09	0.99 (0.32, 3.04)	0.98	2.06 (0.53,8.01)	0.30	1.23 (0.62,2.44)	0.56	4.24 (1.36,13.19)	0.01*
Income														
<NGN 20,000	1		1		1		1		1		1		1	
NGN 20,000-70,000	0.98 (0.67,1.42)	0.90	1.07 (0.61,1.88)	0.80	1.28 (0.85,1.92)	0.24	0.69 (0.38,1.26)	0.23	3.01 (1.32,6.90)	0.01*	0.95 (0.65,1.38)	0.79	1.22 (0.70,2.14)	0.49
NGN70,000-120,000	0.96 (0.57,1.62)	0.88	0.70 (0.29,1.70)	0.43	2.21 (1.28,3.80)	0.00*	0.55 (0.26,1.16)	0.12	8.30 (3.47,19.82)	0.00*	0.77 (0.46,1.30)	0.33	1.10 (0.50,2.44)	0.81
>NGN 120,0000	0.88 (0.52,1.50)	0.65	0.48 (0.71,3.06)	0.30	1.81 (1.04,3.16)	0.04*	0.98 (0.42,2.26)	0.96	19.79 (8.50,46.09)	0.00*	0.75 (0.44,1.26)	0.28	1.32 (0.63,2.77)	0.46
Accuracy														
Inaccurate	1		1		1		1		1		1		1	
Accurate	0.72 (0.47,1.11)	0.13	1.04 (0.54,2.00)	0.91	1.56 (0.93,2.59)	0.09	0.87 (0.43,1.76)	0.69	1.45 (0.71,2.98)	0.31	1.35 (0.88,2.09)	0.17	0.70 (0.39,1.28)	0.25

* p value <0.05. **Accuracy: for the purpose of this study synonymous with Perceived accuracy of information.

Table 4. Association between sociodemographic factors and number of information sources using a multiple linear regression analysis

Variable	β (95% CI)	t test	p value
Age [in years]	-0.00 (-0.02,0.02)	-0.01	0.99
Sex			
Male	1		
Female	-0.11 (-0.33,0.13)	-0.90	0.37
Marital status			
Single			
Married	-0.30 (-0.70,0.09)	-1.50	0.14
Ever married	-0.32 (-1.48,0.83)	-0.55	0.58
Education			
Secondary school or less	1		
University/ Polytechnic	-0.10 (-0.47,0.28)	-0.50	0.62
Postgraduate	0.73 (-0.42,0.57)	0.29	0.77
Income [in NGN]			
<20,000	1		
20,000-70,000	0.08 (-0.19,0.36)	0.58	0.56
>70,000-120,000	0.19 (-0.19,0.57)	0.98	0.33
>120,000	0.45 (0.07,0.83)	2.30	0.02*
Perceived accuracy of information			
Inaccurate	1		
Accurate	0.06 (-0.26,0.38)	0.34	0.73

* p value <0.05

Family and friends

More than one-third of respondents (37.4%) obtained COVID-19 information from family and friends [Table 1]. Bivariate logistic regressions showed that married respondents had lower odds of obtaining COVID-19 information from family and friends compared to single respondents (OR: 0.66; 95% CI: 0.44,0.98) [Table 2]. No significant association was obtained between age, sex, education, income status, perceived accuracy and family and friends as a source of COVID-19 information.

Place of religious worship

Only 12% of respondents obtained COVID-19 related information from their respective places of worship [Table 1]. There was no significant association between sociodemographic factors (age, sex, marital status, education, and income) and perceived accuracy with 'place of worship' as a source of COVID-19 information [Tables 2 and 3].

Health care providers

Twenty-nine percent of respondents obtained COVID-19 information from their health care providers [Table 1]. Married respondents had lower odds of obtaining COVID-19 information from health care providers compared to single respondents (OR: 0.60; 95% CI: 0.38,0.93). In addition, respondents with a university degree and those with a postgraduate degree respectively had lower odds of obtaining COVID-19 information from health care providers compared to respondents with a secondary school degree or less [Table 2]. Respondents earning a monthly income between NGN 70,000-120,000 had 1.75 higher odds of obtaining COVID-19 information from health care providers compared to respondents earning less than NGN 20,000 (95% CI: 1.05,2.91).

Table 3 shows multivariate logistic regressions assessing the effect of sociodemographic factors on source of COVID-19 information. Being married and having a university/ polytechnic education was significantly associated with reduced odds compared to being single and with secondary school education or less, respectively. Also, respondents with a monthly income above NGN 70,000 had significantly higher odds of obtaining COVID-19 information from health care providers compared to respondents earning less than NGN 20,000 (aOR: 2.21; 95% CI: 1.28,3.80).

Internet

Most respondents (89.3%) obtained COVID-19 information from the internet [Table 1]. Respondents earning a monthly income between NGN 70,000-120,000 had lower odds of obtaining COVID-19

information from the internet compared to respondents earning less than NGN 20,000 (OR: 0.49; 95% CI: 0.24,0.98) [Table 2]. However, after adjusting for sociodemographic factors (age, sex, marital status, education) and perceived accuracy, there was no significant association between income levels and use of the internet as a source of COVID-19 information (aOR: 0.55; 95% CI: 0.26,1.16) [Table 3].

Workplace

COVID-19 information from workplace was significantly associated with age, marital status, education and monthly income. For every one-year increase in age, there was a 1.04 increase in the odds of obtaining COVID-19 information from the work-place (95% CI: 1.02,1.06). Similarly, married respondents had 1.91 higher odds of obtaining COVID-19 information from the workplace compared to single respondents (95% CI: 1.16,3.13). Post-graduate education (OR: 6.72; 95% CI: 1.97,22.96) and higher income: above NGN 120,000 (OR: 16.78; 95% CI: 7.89,35.68) were also significantly associated with the ‘work-place’ as a source of COVID-19 information [Table 2]. Similarly, in the multivariate logistic regression model, income remained significantly associated with the work-place as a source of COVID-19 information. Respondents earning NGN 20,000 and above had significantly higher odds of obtaining COVID-19 information from their work-place compared to respondents earning less than NGN 20,000 (aOR: 3.01; 95% CI: 1.32,6.90) [Table 3].

Traditional media

About 62.9% of respondents used traditional media as a source of COVID-19 information [Table 1]. Older age was significantly associated with the use of traditional media as a source of COVID-19 information (OR: 1.02; 95% CI: 1.00,1.04). Married respondents also had 1.80 higher odds of using traditional media as a source of COVID-19 information (OR: 1.80; 95% CI: 1.20,2.71) compared to single respondents [Table 2]. In a multivariate logistic regression analysis, after adjusting for age, sex, education, income and perceived accuracy, being married remained statistically significantly

associated with using traditional media as a source of COVID-19 information (aOR: 1.83; 95% CI: 1.04,3.25) [Table 3].

Posters and banners

About twelve percent (12.4%) of the respondents surveyed reported that they obtained COVID-19 information from public posters and banners. Female respondents had 0.56 lower odds of using this source of information compared to males (OR: 0.56; 95 CI: 0.36,0.88). On the other hand, respondents with postgraduate education had 2.75 higher odds of obtaining COVID-19 information from public posters and banners compared to respondents with secondary school education or less (95% CI: 0.99,7.63). In the multivariate logistic regression analysis, the use of public posters for obtaining COVID-19 information remained significantly associated with lower odds in females compared to male (aOR: 0.55; 95% CI: 0.34,0.88). Also, respondents with postgraduate education still had higher odds of obtaining information from posters and banners compared to secondary school or less (aOR: 4.24; 95% CI: 1.36,13.19) [Table 3].

Association between COVID-19 information sources and perceived accuracy

Table 4 shows a multiple linear regression model demonstrating participants who earn above NGN 120,000 have 0.45 more sources of COVID-19 information on average (β: 0.45; 95% CI: 0.07,0.83), compared to those who earn less than NGN 20,000 per month. Therefore, respondents who earn more are more likely to have a broader source of information. Also, a Poisson regression model with sources of information as dependent variable and sociodemographic factors, perception of accuracy as independent variables (Table D, Appendix I). Compared to respondents earning less than NGN 20,000, the difference in the log count of number of information sources increased by 0.16 for respondents earning NGN 120,000 or more, while holding age, sex, marital status, educational level and perceived accuracy constant (95% CI:0.02,0.32). No significant association was seen between age, sex, marital status, education, and number of COVID-19 information sources.

The majority (85.8%) of respondents reported that their source(s) of information was accurate [Table 1]. However, there was no statistically significant association between perceived accuracy and each source of information or number of sources of information [Tables 2-4].

Assessment of responses on means of differentiating between accurate and inaccurate COVID-19 information was conducted by asking an open-ended question: "*How do you differentiate between accurate and inaccurate COVID-19 information*". One major theme emerged from the responses obtained. Respondents (n=129) used information from recognized local and international health regulatory organisations (now termed 'reputable' sources) such as, the Nigeria Centre for Disease Control (NCDC), the COVID-19 Presidential Task Force in Nigeria (PTF), the Lagos State Ministry of Health (LSMoH), World Health Organisation (WHO) and allusion to a government or official agency to determine accuracy. Some open-ended responses in this cohort of respondents include:

56-year-old, married, male: "I rely on confirmed media accounts of Government agencies NCDC, LSMOH, COVID19 PTF."

25-year-old, single, female: "I cross check with the verified source of information e.g. WHO, NCDC, LSMOH"

Among respondents who perceived their source(s) of information as accurate, eighty-three were confident of the accuracy of information from the NCDC. Statements such as:

27-year-old, married, female: "Any news different from the NCDC's is not always accurate"

In addition, for thirty-eight respondents, information from the WHO website was deemed accurate. This could be inferred from the respondent statements:

25-year-old, single, male: "When it's from a verified source, like WHO, I know it's accurate",

Other ways of determining accuracy include cross-checking multiple sources (n= 37):

36-year-old, married, female: "When same news repeats itself in different places I see it as accurate".

In a subgroup analysis on the use of reputable sources of information, respondents earning between NGN 20,000 and NGN 70,000 had 2.03 higher odds of using reputable sources compared to

respondents earning less than NGN 20,000 (95% CI:1.21,3.38) [Table B Appendix I]. In addition, Table C [Appendix 1] distinguishes between the sociodemographic characteristics of respondents who use reputable sources of COVID-19 information and those who use other sources of COVID-19 information.

Discussion

Principal finding:

This study assessed common sources of COVID-19 information for a population in Nigeria during the early stages of the pandemic. Findings from this study suggest that most respondents used the internet as a source of COVID-19 information. Further, more than two-thirds of respondents considered their source(s) of information as accurate; and one-third depended on only one out of the seven potential sources of COVID-19 information. However, there was no significant association between any of the potential sources of COVID-19 information and perceived accuracy. In addition, high-income earners (> NGN 120,000) had a higher likelihood of using more than one source of COVID-19 information.

The study findings have shown that the internet was the most common source of information amongst the respondents. This contrasts with findings from the EVD outbreak in Nigeria six years ago, where traditional media (television and radio) were the main sources of EVD information at that time [11]. Similarly, a study in Vietnam listed mass media and peer educators as the most common sources of COVID-19 information as opposed to the internet [12]. Nonetheless, several studies in Nigeria and Asia have identified the social media (a component of the internet information source) as an important source of information, particularly serving as the first source of information during the 2014 EVD outbreak in Nigeria [7,11,12]. Given the worldwide advancement in technology, the internet may be a common source of COVID-19 information now more than before because of the wider access to smartphones and internet networks in the country [14-17]. Asides wider access to the

internet, access to real-time health information, with audio-visual tools such as YouTube which can enhance user attention, and the demographics of a majority of respondents: young, educated and living in major cities, may contribute to the dominant use of the internet during the present pandemic in this study [16-17]. Despite these, there is broad consensus that misinformation is highly prevalent on the internet, and challenges such as limited reach to underserved populations may caution against over-reliance on the internet for health communication [18]. Nonetheless, using the internet -through social media handles and websites- for public health messaging accomplishes several goals of successful health communication. These goals include reaching a broad audience, creating interactive and ongoing community engagement, and broadening the transmission of urgent public health information [6,14].

Of note in this study is the relatively low proportion of respondents who depended on health care providers for their COVID-19 related information. This was particularly common in more educated respondents (university education and above) compared to those with secondary school education or less. On the other hand, respondents with higher-income were more likely to obtain COVID-19 information from health care providers compared to the lowest category of income-earners in the population studied. A possible explanation for this finding could be that higher-income earners are more likely to have access to health care providers compared to low-income earners through health insurance or their own ability to pay out of pocket. In addition, higher-income earners are more likely to be able to afford medical consultations, giving direct access for COVID-19 information from health care providers. Similarly, higher-income earners were more likely to obtain COVID-19 information from their workplace. This finding could be ascribed to a likelihood of having more stable white- or blue-collar jobs compared to lower income earners who are mostly students on stipends, small business entrepreneurs and sometimes daily wage earners.

Regarding perceived accuracy, this was not significantly associated with any particular source of COVID-19 information, however, respondents determined the accuracy of their COVID-19

information by cross-referencing with perceived reputable sources of information such as the NCDC and the WHO digital media handles. We define ‘reputable’ internet sources as internet sources (as defined in the methodology) run by national or multi-national health regulatory organisations. In an analysis of sources of information, high income earners had more than two times higher odds of using reputable sources of information compared to low-income earners. Overall, our findings correspond with literature which indicates that a large proportion of the population relies on the media, family and friends to inform their perception of health risk in an outbreak [6].

Limitations in the interpretation of findings from this study could be the mode and language of data collection. Since the study used an online survey in English language, respondents were individuals with access to the internet and could communicate in English, alienating segments of the population with limited access to the internet or did not understand the English language. Nonetheless, it is worth noting that individuals with internet access can serve as sources of information for those with limited or no access to the internet. In addition, respondents were predominantly youth, university/ polytechnic education and earning less than NGN 20,000 per month, therefore limiting the generalizability of our findings.

Conclusion

In conclusion, the internet was the most common source of COVID-19 information, and the population sampled had a relatively high level of perceived accuracy for the COVID-19 information received. Further, high-income earners had a higher likelihood of using multiple sources of COVID-19 information. To determine the accuracy of COVID-19 information, a significant fraction of respondents cross-referenced any information received with news from the government official regulatory bodies (e.g. NCDC) and the WHO.

The dissemination of timely and accurate health information to support public health interventions is crucial during a pandemic. Therefore, targeted and evidence-based approaches must be implemented

for effective communication. Findings from this study can inform health communication measures to mitigate the effects of the COVID-19 pandemic on the population and reduce the burden and spread of the disease.

Effective communication requires sensitivity to social perceptions and dissemination of information via relevant communication channels [19,20], as identified from this study. Policymakers responsible for COVID-19 risk communication in Nigeria may consider measures such as an increased focus on the internet: use of social media handles of the NCDC and local traditional media stations with an online presence. In addition, blue and white-collar employers can be encouraged to promote anti-COVID-19 health behaviours by conducting health education exercises for employees using official digital channels. Future studies should examine the content on COVID-19 across various potential sources of information to better understand the information obtained by the public on dominant information channels.

Acknowledgements: The authors would like to acknowledge the Directorate of Planning, Research and Statistics of the Lagos State Ministry for Health for significant contribution to the data collection.

Funding: Self- funded.

Competing Interests: The authors declare no competing interests.

Data sharing: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Appendix

Supplementary files

Table A. descriptive statistics of demographic variables and perceived accuracy by COVID-19 Information sources

	Variables	**Family and Friends n (%)**	**Place of worship n (%)**	**Health care provider n (%)**	**Internet n (%)**	**Work-place n (%)**	**Traditional media n (%)**	**Public posters and banners n (%)**
		269 (100)	86 (100)	210 (100)	642 (100)	90 (100)	452 (100)	89 (100)
Age [In years]	<35	243 (90.3)	75 (87.2)	192 (91.4)	567 (88.3)	71 (78.9)	387 (85.6)	82 (92.1)
	≥35	26 (9.7)	11 (12.8)	18 (8.6)	75 (11.7)	19 (21.1)	65 (14.4)	7 (7.9)
Sex	Male	112 (41.6)	41 (47.7)	104 (49.5)	297 (46.3)	49 (54.4)	215 (47.6)	52 (58.4)
	Female	157 (58.4)	45 (52.3)	106 (50.5)	345 (53.7)	41 (45.6)	237 (52.4)	37 (41.6)
Marital Status	Single	224 (83.3)	70 (81.4)	178 (84.8)	517 (80.5)	63 (70.0)	343 (75.9)	74 (83.1)
	Married	42 (15.6)	16 (18.6)	30 (14.3)	120 (18.7)	27 (30.0)	103 (22.8)	15 (16.9)
	*Ever married	3 (1.1)	0 (0)	2 (0.9)	5 (0.8)	0 (0)	6 (1.3)	0 (0)
Educational	≤High school	32 (11.9)	8 (9.3)	33 (15.7)	69 (10.7)	3 (3.3)	45 (10.0)	5 (5.6)
	University	195 (72.5)	60 (69.8)	141 (67.1)	459 (71.5)	59 (65.6)	318 (70.3)	63 (70.8)
	Postgraduate	42 (15.6)	18 (20.9)	36 (17.1)	114 (17.8)	28 (31.1)	89 (19.7)	21 (23.6)
Income	<NGN 20,000	114 (42.4)	32 (37.2)	73 (34.8)	263 (41.0)	9 (10.0)	180 (39.8)	32 (36.0)
	NGN 20,000-70,000	83 (30.9)	26 (30.2)	66 (31.4)	189 (29.4)	18 (20.0)	133 (29.4)	27 (30.3)
	NGN70,000-120,000	31 (11.5)	7 (8.1)	32 (15.2)	72 (11.2)	17 (18.9)	53 (11.7)	10 (11.2)
	>NGN 120,0000	41 (15.2)	21 (24.4)	39 (18.6)	118 (18.4)	46 (51.1)	86 (19.0)	20 (22.5)

* Ever married (divorced/ separated/ widow/ widower)divorced/ separated

Table B. Association between the use of a 'Reputable' source of COVID-19 information and sociodemographic factors

	[1]Use of a '*Reputable*' COVID-19 information source	
Variable	aOR (95% CI)	p value
Age [in years]	0.98 (0.95,1.01)	0.18
Sex		
Male	1	
Female	1.09 (0.72,1.65)	0.68
Education		
Secondary school or less	1	
University/ Polytechnic	0.67 (0.36,1.26)	0.21
Postgraduate	0.79 (0.35,1.82)	0.59
Income [in NGN]		
<20,000	1	
20,000-70,000	2.03 (1.21,3.38)	0.01*
>70,000-120,000	2.33 (1.18,4.59)	0.01*
>120,000	2.95 (1.51,5.75)	0.001*
Perceived accuracy of information		
Inaccurate	1	
Accurate	1.98 (0.99,3.95)	0.054

[1]'Reputable' information source was determined using a response to Q.A.8 [see survey questions] indicating use of any of the following as a source of information for differentiating between accurate and inaccurate COVID-19 information: NCDC, WHO, LSMOH, FMOH, CDC, COVID-19 PTF, and official government websites or social media handles. * p value <0.05.

Table C. Descriptive analysis of Population who used 'reputable' information sources

Study characteristic		Reputable source (%)	Other source (%)	p value
		n = 118 (100)	n = 601 (100)	
Age	<35 years	99 (83.9)	534 (88.2)	
	≥ 35 years	19 (16.1)	67 (11.2)	
Sex	Male	53 (44.9)	276 (45.9)	0.84
	Female	65 (55.1)	325 (54.1)	
Marital status	Single	96 (81.4)	475 (79.0)	0.47
	Married	22 (18.6)	119 (19.8)	
	[1]Ever married	0 (0)	7 (1.2)	
Education	Secondary school or less	16 (13.6)	59 (9.8)	0.22
	University/ Polytechnic	77 (65.2)	439 (73.0)	
	Postgraduate	25 (21.2)	103 (17.2)	

Income [in NGN]	<20,000	31 (26.3)	257 (42.8)	0.01*
	20,000-70,000	42 (35.6)	172 (28.6)	
	>70,000-120,000	17 (14.4)	69 (11.5)	
	>120,000	28 (23.7)	103 (17.1)	
Perceived accuracy	Inaccurate	10 (8.5)	92 (15.3)	0.052
	Accurate	108 (91.5)	509 (84.7)	

* p value <0.05.[1] Ever married: Divorced, separated, widow, widower.

Table D. Association between sociodemographic factors and number of [1]information sources using a Poisson regression model.

Variable	β (95% CI)	p value
Age [in years]	0.00 (-0.01,0.01)	0.99
Sex		
Male	1	
Female	-0.04 (-0.14,0.05)	0.39
Marital status		
Single		
Married	-0.12 (-0.28,0.05)	0.16
Ever married	-0.13 (-0.63,0.37)	0.60
Education		
Secondary school or less	1	
University/ Polytechnic	-0.04 (-0.19,0.12)	0.63
Postgraduate	0.03 (-0.17,0.23)	0.80
Income [in NGN]		
<20,000	1	
20,000-70,000	0.03 (-0.08,0.15)	0.58
>70,000-120,000	0.07 (-0.08,0.23)	0.35
>120,000	0.16 (0.02,0.32)	0.03*
Perceived accuracy of information		
Inaccurate	1	
Accurate	0.02 (-0.11,0.16)	0.74

* p value <0.05. [1] a range of 1-7 sources of COVID-19 information sources.

SURVEY QUESTIONS

A.1 Age [at last birthday]: --------- **(**in years**)**

A.2 Sex: a. Female ( ) b. Male ( )

A.3 Marital status: [select only one option]

a. Single []

b. Married []

c. Divorced []

d. Widow/ Widower []

e. Separated []

A.4 Educational level [select only one option]

a. High school or Less than high school []

b. College/ Polytechnic []

c. Postgraduate []

A.5 What is your monthly income? [select only one option]

a. <NGN20,000 []

b. NGN20,000-70,000 []

c. NGN70,000-120,000 []

d. NGN>120,000 [].

A.6 Where do you obtain your information about COVID-19 from? [select all that apply]

a. Family members or friends []

b. Place of worship []

c. Health Care providers (Doctors/Nurses/Pharmacists) []

d. Internet (Facebook/WhatsApp/Instagram/twitter/websites/ blogs) []

e. Work-place []

f. Traditional media (television or Radio or Newspapers) []

g. Public posters and banners []

h. Others (please specify……...)

A.7 Do you think your source of information is accurate? [select only one option]

a. Yes []

b. No []

A.8 How do you differentiate between accurate and inaccurate COVID-19 information? [open ended response]

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Supplementary Files