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Willingness to Accept COVID-19 Vaccine and Its Determinants among Nigeria Citizens: A Web-based Cross-sectional Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: The peculiarity in Nigerians' demographic, socio-economic and cultural pattern necessitated the need to explore potential COVID-19 vaccine acceptance. This study investigated the determinants of willingness to receive COVID-19 vaccine in Nigeria.
Methods: An online cross-sectional study among the general population in Nigeria. Data were collected using an electronic questionnaire. A total of 368 individuals participated in the research. The outcome variable was willingness to accept COVID-19 vaccine coded as "Yes=1 and No=0."

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Basic socio-demographic information of participants and other information related to COVID-19 were obtained. Stata MP 14 was used for the statistical analysis. Descriptive statistics were presented, test of association were carried out using chi square and a binary logistic regression was used to assess the determinants of willingness to accept COVID-19 vaccine. All analyses were performed at 5% level of significance.

Results: The mean age of the respondents was 29.4 ± 9.65 years. Majority of the study participants were female (58.9%), Yoruba (74.7%) and dwellers of urban area (68.5%). Also, 85.6% have attained tertiary level of education. Two-fifth (40.5%) of respondent reported their willingness to take the COVID-19 if made available. Majority (69.8%) of those that are willing to take the vaccine would prefer a live attenuated form and 39.6% would prefer the vaccine administered intramuscularly.

Age group≥40 years (AOR: 5.20, CI: 1.02- 26.41), currently married (AOR: 2.81, CI: 1.05 – 7.53) and susceptibility to COVID 19 infection (AOR: 2.52, CI: 1.21 – 5.26) were associated with likelihood of willingness to accept COVID-19 vaccine.

Conclusion: Despite the fact that majority were at risk of COVID-19 infection, willingness to receive COVID-19 vaccine was low among Nigerians. Level of maturity in terms of age and marriage as well as susceptibility to COVID-19 infection increased the likelihood of accepting COVID-19 infection. In Furtherance, younger ones, unmarried and non-susceptible individual may require more efforts tailored towards enrichment of understanding about the importance of COVID-19 vaccine in other to improve the acceptance of COVID-19 vaccine in Nigeria.

Keywords: COVID-19; vaccine; infection and Nigeria.

1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious disease primarily caused by the newly discovered specie of corona virus [1]. The disease has affected more than 79 million people worldwide with more than one million mortalities recorded. In Africa , over a million cases have been documented, and more than 24,000 deaths across 47 countries [1]. As at 23rd February 2021, Nigeria has 152,616 total confirmed cases and more than a thousand deaths [1,2]. Although, Africa has experienced a mild rate of infections compared to countries in America, Asia and Europe, the need for vaccine has been highlighted because of high rate of the virus transmission [3].

Development of a vaccine for COVID-19 prevention has been affirmed by nations as the most appropriate intervention to mitigate the spread of the virus [4,5]. Although, there has been different concerns from people all over the world about the safety of COVID-19 vaccine. Misinformation about the actual existence of COVID-19 and the fast-tracked discovery of the vaccine could mitigate against vaccine acceptance [2]. Low level of acceptance, and hence coverage of vaccination could hamper the success of immunization against COVID-19 when it is eventually introduced. In Africa, the issue of vaccine hesitancy which is defined as "delay in acceptance or refusal of vaccines despite the availability of vaccination services" has been reported [6,7]. This suggests that the availability of vaccine does not necessarily imply its uptake. For example, a study in Nigeria on acceptability and willingness to pay for hypothetical Ebola vaccine showed that majority of those that were willing to take the Ebola vaccine affirmed they would only accept the vaccine after observing the outcome on others [8]. This revealed reluctance of people towards uptake of vaccine, and the same could be expected for COVID-19 vaccine when introduced. In a global survey of potential COVID-19 vaccine acceptance, majority reported willingness to take the COVID-19 vaccine when available. Although the acceptance rate was higher in Asia countries compared to Europe and some middle-income countries [9]. In contrast, in the United States willingness to accept COVID-19 vaccine was 67% [10].

Given the history of Nigerians with immunization, it is necessary to investigate the willingness of Nigerians to uptake the COVID-19 vaccine when it is introduced to the country. Hence, this study aimed to understand the knowledge of COVID-19 and potential hesitancy of COVID-19.

Following the announcement by the WHO on the availability of the COVID-19 vaccine, there is the need to assess Nigerians' willingness to receive the vaccine. Reports from the media are mostly anecdotal and many times are not representative. With a high level of denial of the existence of COVID-19 and carefree

attitude of citizens to preventive measures, it is important to document the potential acceptance of COVID-19 vaccine among Nigeria citizens. Our study is one of the first in Nigeria to study the willingness of Nigerians to accept the COVID-19 when introduced into the country.

The peculiarity in Nigerians' demographic, socio-economic and cultural pattern necessitated the need to explore potential COVID-19 vaccine acceptance. This study investigated the determinants of willingness to receive COVID-19 vaccine in Nigeria (a low resource setting).

2. METHODS

A web-based cross-sectional study was conducted in December 2020 among the general population in Nigeria. Data were collected using an electronic questionnaire. The questionnaire was designed on kobo toolbox [11] and administered through WhatsApp, Telegram, Facebook, Instagram platforms. Filling the self-administered and anonymous questionnaire required about 15 minutes. Respondents could only fill the questionnaire once using the link, and there was no opportunity to edit responses after submission (this was a restriction done in the database, only one submission is allowed from each device so as to restrict multiple submission from each respondents) . Link to the questionnaire was sent by the researchers to respondents. Participants were also encouraged to share the same link with others on their contact list. Nigerians were eligible to participate if they: (1) were 18years and older (2) have an internet-enabled phone (3) could read English language (4) were willing to participate in the study. Members of the research team were exempted from participating in the research.

A total sample size of 368 was calculated using the formula $n = \frac{Z^2 * (P) * (1-P)}{d^2}$ where Z= 1.96 C=0.05 p=0.91 as obtained in a study conducted in China [12], design effect of 2.5 and adjustment for non-response rate of 15%.

2.1 Study Variables

Basic socio-demographic information of participants were obtained. The outcome variable that measured willingness to accept COVID-19 vaccine was presented as "Will you receive COVID-19 vaccine if made available?" responses were coded as "Yes=1, No=0 and Not sure=0." Other questions asked include: "Is COVID 19 Vaccine available in your state or nearby?. Also, 8-items instrument was used to assess the knowledge of respondents on COVID-19. Further information about this instrument is available on a paper published by Eniade et al. [13]. Respondents who reported willingness to receive the vaccine were asked the type of vaccine preferred, (live attenuated vaccine coded as 1, inactivated vaccine coded as 2, DNA vaccine coded as 3, recombinant vaccine coded as 4), and the preferred route of vaccine administration (oral coded as 1, intramuscular coded as 2, subcutaneous coded as 3). Also, respondents who reported unwillingness to take the vaccine were asked the reasons for their response. Options provided were "perceived risk" coded as 1 and "lack of trust in the government system" coded as 2.

2.2 Data Analysis

The dataset was exported from Kobo toolbox to excel sheet on a computer with password, and then exported into Stata MP 14 for analysis. Frequencies and percentage distribution were computed to describe the socio-demographic characteristics, willingness to receive COVID-19 vaccine, and other explanatory variables. Association between willingness to accept COVID-19 vaccine and the categorical explanatory variables were tested using the chi-square test. A binary logistic regression was used to assess the determinants of willingness to accept COVID-19 vaccine. Analysis was performed at 5% level of significance [14].

3. RESULTS

3.1 Socio-demographic Characteristics of Respondents

A total of 368 respondents participated in this study, with a mean age of 29.4 $\pm$ 9.65 years. Majority were in the age group 20-29years (51.0%), female (58.9%), Yoruba (74.7%), had tertiary education (85.6%), and lived in the urban area (68.5%). (Table 1).

Table 1. Socio-demographic characteristics

Variables	Frequency (n=368)	Percent (%)
Age Mean (SD): 29.4(9.65)		
Age group (years)		
<20	32	8.7
20-29	187	51
30 -39	90	24.5
>=40	58	15.8
Type of residence		
Urban	252	68.5
Rural	116	31.5
Gender		
Male	151	41.1
Female	7216	58.9
Marital status		
Single	239	64.9
Married	123	33.4
Widowed	6	1.6
Ethnicity		
Yoruba	275	74.7
Igbo	27	7.3
Hausa	12	3.3
Others	54	14.7
Religion		
Christian	314	85.6
Muslim	51	13.9
Others	2	0.5
Highest level of education		
Primary	8	2.2
Secondary	39	10.6
Tertiary	320	87.2
Occupation		
Unemployed	165	44.8
Health worker	41	11.1
Civil servant	68	18.5
self employed	33	9
Private sector	61	16.6

3.2 Knowledge of COVID-19

Majority (88.9%) of the respondents agreed that COVID-19 is real. Common sources of information about COVID-19 were social gathering (71.7%), and the internet (66.3%), while the print media was the least source of information (8.5%). Less than a quarter (23.4%) of respondents in this study knew someone who tested positive for COVID-19. More than half (60.1%) reported that their jobs put them at the risk of COVID-19. However, one-third (31.0%) reported high level of risk in contracting COVID-19 (Table 2).

3.2.1 Willingness to receive COVID-19 vaccine

Two-fifth (40.5%) of respondent reported their willingness to take the COVID-19 if made available. Majority (69.8%) of those that are willing to take the vaccine, would prefer it in a live attenuated form and 39.6% would prefer the vaccine administered intramuscularly. The major reasons cited among those unwilling to take the vaccine were lack of trust in the government system (44.7), and perceived risk (33.1%) (Table 3).

3.2.2 Factors associated with willingness to receive COVID-19 vaccine

Respondents who were 40years and above, whose job put them at risk, and considered themselves to be at risk, were significantly willing to take the COVID-19 vaccine ($p < 0.05$). Although respondents who were married, had higher level of education, reside in urban areas,

and health care workers reported more willingness to take the COVID-19 vaccine, this was not statistically significant ($p > 0.05$) (Table 4).

3.2.3 Relationship of determinant of willingness to receive COVID 19 vaccine with respondent's profile

Table 5 showed the factors influencing the willingness to receive COVID 19 vaccine. Respondents within age group 20-29years (AOR: 6.96, CI: 1.98 – 24.43), and age group≥40 years (AOR: 5.20, CI: 1.02- 26.41) were more likely to receive COVID 19 vaccine compared with those in younger age group. Similarly, married respondents (AOR: 2.81, CI: 1.05 – 7.53) compared to singles and those who were susceptible to COVID 19 (AOR: 2.52, CI: 1.21 – 5.26) compared to their non-susceptible counterparts were associated with likelihood of receiving COVID-19 vaccine.

Table 2. Knowledge of COVID-19

Variables	Frequency (n=368)	Percent (%)
Is COVID 19 real?		
Yes	327	88.9
No	18	4.9
I don't know	23	6.3
Sources of COVID-19 information		
Internet Yes	244	66.3
Social media Yes	83	35.3
News paper Yes	20	8.5
TV/ Radio Yes	90	38.3
Religious gathering Yes	45	19.1
Community member Yes	31	13.2
Social gathering Yes	165	71.7
Do you know anyone who has tested positive for COVID-19?		
Yes	86	23.4
No	282	76.6
If yes, what is your relationship with the person		
Neighbor	5	5.8
Colleague	13	15.1
Family member	12	14.0
Friends	18	20.9
Others	38	44.2
Has the person recovered?		
Yes	74	86.0
No	7	8.1
I don't know	5	5.8
Does your job put you at risk of COVID-19?		
Yes	208	60.1
No	138	39.9
Do you consider yourself susceptible to COVID-19		
Yes	129	38.6
No	161	48.2
I don't know	44	13.2
If yes, how do you rate your potential level of risk ovid-19		
Low	18	25.4
Moderate	31	43.7
High	22	31.0

Table 3. Willingness to receive COVID-19 vaccine

Variables	Frequency (n=368)	Percent (%)
Is COVID-19 Vaccine available in your state?		
Yes	178	48.4
No	147	39.9
Maybe	43	11.7
Will you receive COVID-19 vaccine if made available in your state or nearby		
Yes	149	40.5
No	154	41.8
Not sure	65	17.7
If No, why would you refuse the vaccine		
Perceived risk	12	31.6
I don't trust the governmental system	17	44.7
Perceived risk and I don't trust the governmental system	3	7.9
Others	4	10.5
Perceived risk, I don't trust the governmental system and others	2	5.3
If yes, which type of COVID-19 vaccine would you		
DNA Vaccine	28	18.8
Live attenuated	104	69.8
Recombinant Vaccine	17	11.4
If yes, which route of vaccine administration would prefer?		
Oral	57	38.3
Intramuscular	59	39.6
Subcutaneous	33	22.1
If No, why would you refuse the vaccine		
Perceived risk	12	31.6
I don't trust the governmental system	17	44.7
Perceived risk and i don't trust the governmental system	3	7.9
Others	4	10.5
Perceived risk, I don't trust the governmental system and others	2	5.3

4. DISCUSSION

Following the announcement by the WHO on the availability of the COVID-19 vaccine, there is the need to assess Nigerians' willingness to receive the vaccine. Reports from the media are mostly anecdotal and many times are not representative. With a high level of denial of the existence of COVID-19 and carefree attitude of citizens to preventive measures, it is important to document the potential acceptance of COVID-19 vaccine among Nigeria citizens. Our study is one of the first in Nigeria to study the willingness of Nigerians to accept the COVID-19 when introduced into the country.

In the present study, majority believed that COVID-19 is real. Respondents have various ways of learning about COVID-19. These sources include internet, social gathering, social media and the TV/radio. However, social gathering was the major source of information. Social gathering was another major way of learning about COVID-19. This showcases the importance of interpersonal communication as a way to pass across health information, even in the digital age. Hence, there is need to give individuals correct information in order to ensure that there is knowledge and eventually a behavioural change. This finding aligns with Xiao's report of a study carried out among College students in the US. Where interpersonal communication was a major source of information [15].

Although many people believe that COVID-19 was real, only 40% were willing to take the vaccine if made available. This study revealed a lower proportion compared to findings in United State (US), Australia and China where higher proportion was reported for "willingness to take the COVID-19 vaccine" [10,16,17]. Respondents' unwillingness to uptake the vaccine was due to lack of trust in the government system and perceived risk of side effects. Reports from high income countries and some low/middle income countries (LMICs) established that trust in the government system is a predictor of willingness to uptake COVID-19 vaccine [17]. Nigeria government has responsibility during and after the COVID-19 pandemic to reassure the citizens of vaccine safety in order to ensure uptake of the vaccine when available. Use of the internet and interpersonal communication approach will

Table 4. Factors associated with willingness to receive COVID-19 vaccine

Variables	Willingness to receive COVID-19 vaccine		χ^2	P value
	Yes	No		
Age				
<20	5(15.6)	27(84.4)	21.87	<0.001
20-29	74(39.6)	113(60.4)		
30 -39	33(36.7)	57(63.3)		
>=40	37(63.8)	21(36.2)		
Type of residence				
Urban	109(43.3)	143(56.7)	2.54	0.111
Rural	40(34.5)	76(65.5)		
Gender				
Male	69(45.7)	82(54.3)	2.76	0.096
Female	80(37.0)	136(63.0)		
Marital status				
Single	84(35.1)	155(64.9)	11.05	0.004
Married	64(52.0)	59(48.0)		
Widowed	1(16.7)	5(83.3)		
Ethnicity				
Yoruba	112(40.7)	163(59.3)	7.76	0.051
Igbo	11(40.7)	16(59.3)		
Hausa	9(75.0)	3(25.0)		
Others	17(31.5)	37(68.5)		
Religion				
Christian	121(38.5)	193(61.5)	3.8	0.05
Muslim	28(52.8)	25(47.2)		
Highest level of education				
Primary	2(25.0)	6(75.0)	0.8	0.708
Secondary	16(41.0)	23(59.0)		
Tertiary	130(40.6)	190(59.4)		
Occupation				
Unemployed	55(33.3)	110(66.7)	6.71	0.152
Health worker	19(46.3)	22(53.7)		
Civil servant	33(48.5)	35(51.5)		
self employed	14(42.4)	19(57.6)		
Private sector	28(45.9)	33(54.1)		
Is COVID 19 real				
Yes	129(39.4)	198(60.6)	5.58	0.062
No	12(66.7)	6(33.3)		
I don't know	8(34.8)	15(65.2)		
Do you know of anyone who have been tested positive for COVID-19				
Yes	36(41.9)	50(58.1)	0.09	0.767
No	113(40.1)	169(59.9)		
Does your job put you at risk of COVID-19?				
Yes	70(33.7)	138(66.3)	9.22	0.002
No	69(50.0)	69(50.0)		
Do you consider yourself susceptible to COVID-19				
Yes	43(33.3)	86(66.7)	12.47	0.002
No	87(54.0)	74(46.0)		
I don't know	19(43.2)	25(56.8)		
If yes, how do you rate your potential risk of exposure to COVID-19				
Low	10(55.6)	8(44.4)	0.67	0.714
Intermediate	19(61.3)	12(38.7)		
High	11(50.0)	11(50.0)		
Will you appreciate the availability of the vaccine in your state?				
Yes	121(68.0)	57(32.0)	110.56	<0.0001
No	26(17.7)	121(82.2)		
Maybe	2(4.7)	41(95.3)		

** (p<0.1); ** (p<0.05)*

Table 5. Determinants of willingness to receive COVID-19 vaccine

			95%CI	
Variables	**AOR**	**P-value**	**Lower**	**Upper**
Age				
<20	Ref			
20-29	6.96	0.002	1.98	24.43
30 -39	1.82	0.410	0.44	7.50
>=40	5.20	0.047	1.02	26.41
Type of residence				
Urban	Ref			
Rural	0.98	0.950	0.48	1.99
Gender				
Male	Ref			
Female	0.57	0.080	0.31	1.07
Marital status				
Single	Ref			
Married	2.81	0.040	1.05	7.53
Widowed	0.54	0.645	0.04	7.35
Ethnicity				
Yoruba	Ref			
Igbo	1.60	0.418	0.51	4.96
Hausa	1.15	0.873	0.22	6.10
Others	0.74	0.527	0.30	1.86
Religion				
Christian	Ref			
Muslim	1.40	0.448	0.59	3.32
Does your job put you at risk of covid-19?				
Yes	Ref			
No	0.77	0.440	0.39	1.51
Do you consider yourself susceptible to Covid-19				
Yes	Ref			
No	2.52	0.014	1.21	5.26
I don't know	1.44	0.475	0.53	3.90
Will you appreciate the availability of the vaccine in your state				
Yes	Ref			
No	0.08	0.000	0.04	0.16
Maybe	0.01	0.000	0.00	0.07

AOR: Adjusted Odd Ratio

suffice in the efforts of the government to gain the trust of the citizens. Government message should focus on the safety, efficacy, and availability of the vaccine. Safety of vaccine was a factor cited in a study in China as a barrier to uptake of COVID-9 vaccine [17].

Older people were significantly willing to uptake the COVID-19 vaccine compared to younger ones. This is not unlikely because the level of understanding and seriousness about health issues among them [18]. Also, many older people have other health conditions that have been identified as predisposing factor to COVID-19 [19,20] and these comorbid conditions increase COVID-19 related morbidity and mortality [21]. Hence, the willingness to uptake the vaccine may be borne out of fear and also reducing severity in case they contract the virus. These results aligned with other studies that older people are more willing to uptake the COVID-19 vaccine [9,16,17]. This study was carried out online, due to the amelioration in communication technology, access to internet has increased significantly [22]. Thereby, a larger proportion of Nigeria have assess to internet. This study has its limitation, not all Nigerians have access to internet, especially in the rural areas and the study duration was short due to the urgent need of information on this subject matter in Nigera [23]. However, this limitation does not erode the strength of this study as it added to knowledge about Nigerians willingness to accept COVID-19 vaccine.

5. CONCLUSION

Despite the fact that majority were at risk of COVID-19 infection, willingness to receive COVID-19 vaccine was low among Nigerians.

Level of maturity in terms of age and marriage as well as susceptibility to COVID-19 infection increased the likelihood of accepting COVID-19 infection. Younger ones should not be left out unconvinced in the importance of COVID-19 vaccine. Further, unmarried and non-susceptible individual may require more efforts tailored towards enrichment of understanding about the importance of COVID-19 vaccine in other to improve the acceptance of COVID-19 vaccine in Nigeria.

CONSENT AND ETHICAL APPROVAL

Participants gave informed consent to participate in the study; they were fully informed about the study and that the data collected will only be used for research purpose.

Tenet of Helsinki declaration and other ethical requirements were adhered with in this study. No personal identifying information was collected from the participants. Hence, the confidentiality and anonymity of the respondents are guaranteed.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. WHO, Coronavirus disease (COVID-19); 2020.
2. NCDC, Nigeria centre for disease control coronavirus COVID-19 Microsite [Internet]; 2021
   [cited 2021 Feb 23];
   Available:https://covid19.ncdc.gov.ng.
   https://covid19.ncdc.gov.ng, 2021.
3. Achoki T, et al. COVID-19 pandemic in the African continent: forecasts of cumulative cases, new infections and mortality. MedRxiv; 2020.
4. Chakraborty C, et al. Extensive partnership, collaboration, and teamwork is required to stop the COVID-19 outbreak. Archives of Medical Research. 2020; 51(7):728-730.
5. Saha RP, et al. Repurposing drugs, ongoing vaccine and new therapeutic development initiatives against COVID-19. Frontiers in pharmacology. 2020;11:1258.
6. Eskola, J., et al., How to deal with vaccine hesitancy? Vaccine, 2015;33(34):4215-4217.
7. Dubé E, et al. Mapping vaccine hesitancy—Country-specific characteristics of a global phenomenon. Vaccine. 2014; 32(49): p. 6649-6654.
8. Ughasoro MD, et al., Acceptability and willingness-to-pay for a hypothetical Ebola virus vaccine in Nigeria. PLoS Negl Trop Dis. 2015;9(6): e0003838.
9. Lazarus JV, et al. A global survey of potential acceptance of a COVID-19 vaccine. Nature medicine. 2020;1-4.
10. Malik AA, et al. Determinants of COVID-19 vaccine acceptance in the US. EClinical Medicine. 2020;26: 100495.
11. Initiative HH, KoBo Toolbox. Cambridge: Harvard Humanitarian Initiative; 2019.
12. Wang J, et al., Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. Vaccines. 2020;8(3): p. 482.
13. Eniade OD, Agbana DE, Afam BO. COVID-19 Knowledge, attitude and prevention practice in southwest Nigeria. AIJR. 2020;1(2).
14. Abreu AA, Stata (Software). The International Encyclopedia of Communication Research Methods. 2017;1-2.
15. Xiao X, Wong RM. Vaccine hesitancy and perceived behavioral control: A meta-analysis. Vaccine. 2020;38(33):5131-5138.
16. Seale H, et al. COVID-19 is rapidly changing: Examining public perceptions and behaviors in response to this evolving pandemic. PloS one. 2020;15(6):e023 5112.
17. Wang K, et al. Change of Willingness to Accept COVID-19 vaccine and reasons of vaccine hesitancy of working people at different waves of local epidemic in Hong Kong, China: Repeated cross-sectional surveys. Vaccines. 2021;9(1): 62.
18. Moore AR, et al. Determinants of rating of the seriousness of health issues facing Americans. Journal of Public Health. 2020; 1-7.
19. Mills JP, Kaye KS, Mody L. COVID-19 in older adults: clinical, psychosocial and public health considerations. JCI insight, 2020; 5(10).
20. Mueller AL, McNamara MS, Sinclair DA. Why does COVID-19 disproportionately affect older people? Aging (Albany NY), 2020;12(10):9959.

21. Colaneri M, et al. Clinical characteristics of coronavirus disease (COVID-19) early findings from a teaching hospital in Pavia, North Italy, 21 to 28 February 2020. Eurosurveillance, 2020;25(16): 2000460.
22. Adeleke R. Digital divide in Nigeria: The role of regional differentials. African Journal of Science, Technology, Innovation and Development. 2020;1-14.
23. Uleanya C, Gamede BT, Kutame AP. Rural and irrelevant: exploration of learning challenges among under-graduates' rural universities. African Identities. 2020;18(4):377-391.

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