



ISSN: 2476-8642 (Print)

ISSN: 2536-6149 (Online)

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**PUBLISHED BY THE MEDICAL
AND DENTAL CONSULTANTS ASSOCIATION
OF NIGERIA, OOUTH, SAGAMU, NIGERIA.**

www.mdcan.outh.org.ng

ORIGINAL RESEARCH

Knowledge of COVID-19, Use of Personal Protective Equipment and Other Safety Practices of Healthcare Workers in Southwest Nigeria

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Abstract

Background: Healthcare workers have a higher risk of SARS CoV2 infection with implications for transmission of infection and the safety of workers and patients.

Objective: To assess knowledge on COVID-19 and the safety practices among selected healthcare workers in southwest Nigeria.

Methods: A cross-sectional study of 210 workers providing direct care to patients during the COVID-19 pandemic was conducted. Respondents were recruited through simple random sampling of members of online platforms of healthcare workers in Osun, Ondo and Ekiti States. Information on sociodemographic characteristics, knowledge of PPE and safety practices was obtained through a close-ended questionnaire.

Results: The mean age of the respondents was 36.5±7.5 years. About 29% and 30% of respondents were from the State and Federal Government-owned Teaching Hospitals, respectively. A little above half (58.1%) had good knowledge of COVID-19, while 62.1% used PPE always when attending to suspected COVID19 cases. More than half (53.8%) had been trained on infection prevention and control (IPC), but only 34.3% adhered to good safety practices. Healthcare workers in State government-owned teaching hospitals had lower odds of good safety practices than those in Federal Teaching Hospitals (OR = 0.42, 95% CI = 0.19-0.93, p = 0.031).

Conclusion: The knowledge of appropriate PPE and practice of safety precautions among healthcare workers is sub-optimal. This may predispose to increased COVID-19 transmission among healthcare workers, patients, and their families. Training and retraining healthcare workers, especially those from hospitals identified by the study as having poor safety practices, should be encouraged.

Keywords: COVID-19, Healthcare workers, Hospital staff, Infection Prevention and Control, Safety practices.

Introduction

The world is currently experiencing a pandemic of COVID-19. The first case of COVID-19 was reported in Wuhan, China, in December 2019. [1] The novel coronavirus has been responsible for almost six million deaths worldwide. [2,3] The morbidity and mortality from SARS-COV-2 infection increased through 2020 and 2021 despite all available pharmacologic and non-pharmacologic methods. [2] Healthcare workers (HCW) are at the frontline of the control efforts against COVID-19 worldwide. [4] The challenges associated with this task include an increased risk of contracting SARS-COV-2 with the attendant morbidity and mortality for different healthcare workers. [4] Healthcare workers are at a greater risk of contracting COVID-19 because of their frequent exposure to patients who can transmit the SARS-COV-2 Virus during asymptomatic infection or even during the incubation period. [5] The new normal in healthcare service delivery entails extra precaution while providing care. Both HCW and patients are expected to use personal protective equipment (PPE) to prevent the transmission of the SARS-COV2 Virus.

A study from Wuhan, China, reported that 29% of cases occurred among HCW. [6] Another study from Canada reported a higher prevalence (0.8%) of infection among HCW than 0.1% prevalence among the general population. [7] A study among healthcare workers in Iran reported that 5.6% of diagnosed COVID-19 infections occurred among healthcare workers, with 51% of the cases among nurses and 10% of infected healthcare workers transmitting the disease to their families. [8] The high rate of infection among healthcare workers is a threat to the proper functioning of the health system, especially in developing countries where the health system is already fragile. [9] In Africa, it has been demonstrated that healthcare workers have higher exposure burdens. For instance, in Ethiopia, a study that assessed COVID-19 exposure risks among healthcare workers

reported that 76% of healthcare workers at a treatment facility had a high exposure risk of COVID-19 infection. [10]

Personal protective equipment (PPE) is a barrier between the user and disease-causing agents such as bacteria, viruses, dust, or polluted air. [11] In the context of COVID-19, the use of PPE is one of the effective ways of preventing COVID-19 infection among HCWs. The commonly used PPE by healthcare workers includes facemask (medical, surgical or N95), hair covers, aprons, goggles, face shield, waterproof overalls, and boots. [12] This is in addition to social distancing, avoiding a crowded gathering, and handwashing. For PPEs to be effective, there is a need for consistency and proficiency in using these devices. [13]

An international study among healthcare workers in the early period of the pandemic reported widespread re-use of PPE that was meant to be single-use, and about 55.8% of HCW re-used surgical masks amidst reports of a general shortage of PPE. [14] Another study in Ethiopia reported only 38.73% of healthcare workers practised good COVID-19 preventive behaviour and female healthcare workers who had more work experience had a greater odds of good COVID-19 preventive practice. [15] The use of PPEs in Nigeria before the COVID-19 pandemic had not been impressive. A survey in 2014 found 89% of HCWs had heard about PPE, 45% had been trained on PPE use, 95% were not aware of any PPE policy at their workplace, and less than 5% used PPE consistently. Another Nigerian survey revealed that 69% of healthcare workers had been trained on PPE use and irregular access to PPE was responsible for 57% of inconsistent PPE use. [16] A more recent study in Nigeria found only 25.7% had good knowledge of PPE use, while 5% had a good attitude towards PPE use. [17]

During the pandemic, safety practices among healthcare workers have not been adequate in

many countries. The factors influencing its use are not well documented in the literature, thus deserving a special focus to inform policies and interventions to protect healthcare workers against COVID-19 disease and its consequences. This study aimed to assess knowledge of COVID-19 among healthcare workers, safety practices of healthcare workers during the COVID-19 pandemic, and factors influencing their use of PPE.

Methods

The research was a cross-sectional, descriptive study of healthcare workers in Osun, Ondo and Ekiti States, Southwest Nigeria. Osun State has a population of about 3.2 million at the last national census in 2006. There are two teaching hospitals, 11 general hospitals (secondary health facilities) and 332 functional Primary Healthcare Centres. There are two major COVID-19 treatment and isolation centres in Osun State, located at Ile-Ife and Osogbo, which accept referrals from other hospitals within the state. There are three tertiary health facilities, three Specialist and 17 General hospitals in Ekiti State, and two major COVID-19 treatment and isolation centres located at Ado-Ekiti and Ido-Ekiti. Ondo State has two tertiary hospitals and 22 General hospitals with two major COVID-19 treatment and isolation centres located at Akure and Owo.

The research team obtained ethical approval for the study from the Institute of Public Health (IPH), Obafemi Awolowo University, Ile-Ife, Osun State, with HREC no: IPH/OAU/12/1591. Informed consent to participate in the study was obtained from all respondents. All information obtained was kept confidential, and no identifying information was collected during the survey.

The participants in this study were recruited between July and August 2020 during the first

phase of the COVID-19 nationwide lockdown. The study included all cadres of healthcare workers (Doctors, Nurses, Pharmacists, Laboratory Scientists) from all departments within the hospitals who provided direct clinical care to patients in these states during the COVID-19 pandemic. The Fisher's formula for estimating simple proportion was used to calculate a minimum sample size of 210 using a prevalence of 17.3% (proportion of respondents with good handwashing practice in Ibadan, South-west Nigeria).^[18] A close-ended questionnaire based on a detailed template from the WHO guidelines on IPC and adapted for the local context was administered online through Kobo Collect ODK.^[19] The questionnaire included sections on sociodemographic characteristics, knowledge of PPE, attitude towards PPE and use of PPE by the respondents. The online link to the questionnaire was shared via the official WhatsApp (WhatsApp Inc, CA, U.S.A.) groups of healthcare workers in various hospitals in the study area. The group administrator sent the links to members selected through simple random sampling. Where the number of responses was not adequate at first instance, the link was sent multiple times until the final day that the Questionnaire was available online. The Questionnaire was available online for 50 days. All the respondents were aware of the study aims, benefits and risks. Duplicate responses were prevented by restricting the number of surveys a single e-mail address can submit to only one. The data were downloaded into Excel® (Microsoft Corp, WA, U.S.A.) and transferred to Stata software version 14 for analysis.

Overall knowledge of COVID-19 was assessed by asking 19 questions on knowledge of the Virus, mode of spread, symptoms, and treatment of COVID-19 and assigning a score of 1 to each correct question. The total correct answers were summed for each respondent, and anyone who had a median score of ≥ 15 was categorized as having good knowledge. In contrast, those who

scored below the median were classified as having poor knowledge.

The variable on safety practice was determined by generating a composite sum of the four main questions on practices that contribute to the safety of health workers while attending to patients. The questions were about handwashing, facemask use, recommended PPE use and supervisor's involvement in enforcing appropriate PPE use. A total score of ≥ 3 was categorized as a good safety practice, while a total score of < 3 was classified as a poor safety practice. The relationship between healthcare workers' sociodemographic characteristics, knowledge, and safety practice was assessed using the Chi-square test of association, and binary logistic regression analysis was employed to determine the predictors of good safety practice among healthcare workers.

Results

Sociodemographic characteristics of respondents.

Two hundred and ten questionnaires were filled out online and submitted. The mean age of respondents was 36.5 ± 7.53 years. Forty-nine (71.0%) respondents were less than 40 years, while 61 (29%) respondents were aged 40 years and above. One hundred and seven (51%) respondents were females (Table I). The majority of respondents (125; 59.5%) worked at a government hospital such as a federal/state teaching hospital or a federal medical centre, 16.7% of respondents worked in a private hospital or mission hospital, and 23.8% of respondents worked in other facilities. These additional facilities included primary health centres and university health centres. Most respondents (145; 69.1%) worked in their hospitals' surgical, medical or paediatric units. Almost half of the respondents (104; 49.5%) had less than 11 years of work experience. Fifty-eight

(29%) respondents cared for suspected COVID-19 cases, while 6.2% were involved in treating laboratory-confirmed COVID-19 patients (Table I).

Knowledge of COVID-19 among Healthcare Workers

Almost all the respondents were aware of COVID-19 (209, 99.5%). The internet (176; 83.8%) and social media platforms (174; 82.9%) were the most common source of information (Table II), while the radio (99; 47.1%) and newspapers (86; 41.0%) were the least cited sources of information about COVID-19 disease. Only 117 (55.7%) respondents were educated through hospital training programs. The mean knowledge score was 14.7 ± 2.3 ; respondents with overall good knowledge of COVID-19 was 58.1% (122/210), while 88 (41.9%) had poor knowledge.

Safety practices among Healthcare workers during COVID-19 pandemic

One hundred and fifty-two (72.4%) had a facility contact person for infection prevention and control (IPC). Only 142 (67.6%) were aware of a protocol for PPE use, while 147 (70%) had COVID-19 treatment protocol in their facilities (Figure 1). Close to two-thirds (62.5%) from state government-owned teaching hospitals, 45.9% of respondents in federal teaching hospitals, and 68.6% from private/mission hospitals were trained on infection prevention and control (IPC). Overall, 113 (53.8%) had been trained on IPC. The proportion of respondents with good knowledge of appropriate PPE use was 56.7%. About two-fifths (40.5%) used recommended PPE always when attending to patients at the general out-patient clinic, 56.2% always used surgical masks while attending to patients, 62.1% always used recommended PPEs, and all HCWs always used the recommended PPE when attending to confirmed COVID-19 cases as shown in Table III. Overall, 65.7% of the respondents had good safety practices, while 34.3% had poor practices.

Table I. Socio-demographic characteristics of respondents

Variables	Frequency (n = 210)	Percentage
Age		
Less than 40 years	149	71.0
40 years and above	61	29.0
Gender		
Male	103	49.0
Female	107	51.0
Marital status		
Married	161	76.7
Single	49	23.3
Facility type		
Federal Teaching Hospital/Federal Medical Centre	61	29.0
State Teaching Hospital	64	30.5
Private/Mission Hospital	35	16.7
Others*	50	23.8
Practice unit		
Surgical	48	22.9
Medical	54	25.7
Paediatrics	43	20.5
A&E	15	7.1
Public Health	26	12.4
Others**	24	11.4
Cadre		
Doctor	139	66.2
Nurse	44	20.9
Others***	27	12.9
Years of Experience		
0 to 10	104	49.5
11 to 20	92	43.8
21 years and above	14	6.7
Treatment Involvement		
Treated confirmed case	13	6.2
Treated suspected case	58	27.6
Treated neither suspected nor confirmed case	139	66.2

*Others included Primary Health Care Centre, Private clinics, Dental clinics, Military hospital

**Intensive care, Laboratory, Pharmacy

*** Pharmacist, Community Health Extension Workers, Laboratory Technicians

Table II: Source of information on COVID-19

Source of information on COVID-19	Frequency* (n =210)	Percentage (%)
Internet	176	83.8
Social Media	174	82.9
Television	167	79.5
Colleagues at work	120	57.1
Hospital Training	117	55.7
Medical and Nursing Journals	113	53.8
Radio	99	47.2
Newspaper	86	41.0

*Some participants gave multiple responses

About two-fifths (40.5%) used recommended PPE always when attending to patients at the general out-patient clinic, 56.2% always used surgical masks while attending to patients, 62.1% always used recommended PPEs, and all HCWs always used the recommended PPE when attending to confirmed COVID-19 cases as shown in Table III. Overall, 65.7% of the respondents had good safety practices, while 34.3% had poor practices.

Association between healthcare workers socio-demographics and safety practice

The type of facility where HCWs worked and previous training on IPC were statistically significantly associated with safety practices. At the same time, gender, professional cadre, years

of experience were not significantly associated with safety practices (Table IV). About half (51.6%) of HCWs in a state government-owned teaching hospital had good safety practices. In comparison, 67.2% of those who worked in federal institutions and 82.9% in private/mission hospitals had good safety practices. The observed differences were statistically significant ($\chi^2 = 10.72$; $p = 0.013$). Similarly, 74.3% of respondents who have had previous training on IPC had good safety practices, while 55.7% of those who have not been trained on IPC had good safety practices ($\chi^2 = 8.07$, $p = 0.004$). Knowledge of COVID-19 transmission, prevention and treatment was also not significantly associated with safety practices ($\chi^2 = 2.32$, $p = 0.13$).

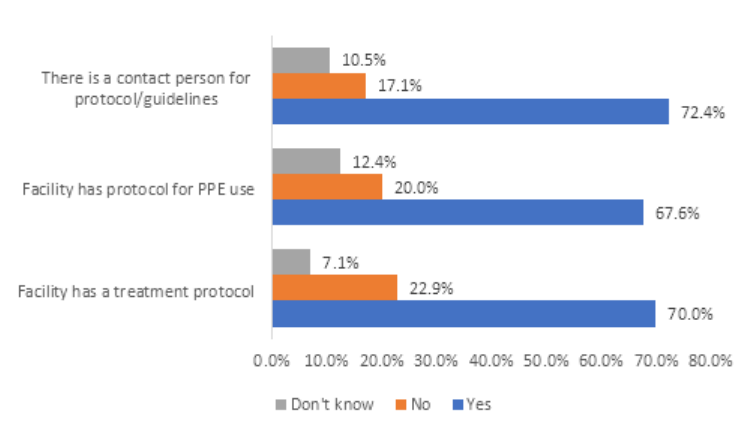


Figure 1: Availability of protocols for infection prevention and control in respondent's facilities

The binary logistic regression analysis of the predictors of good safety practice showed that HCW cadre, previous training on IPC and the facility type were significant predictors of good safety practice among HCW (Table V). Nurses were about four times less likely to practice safely than medical doctors. (OR = 0.27, CI = 0.11-0.67, $p = 0.005$). Also, HCWs trained on IPC were about three times more likely to have good safety practices than their untrained counterparts. (OR = 2.93, CI = 1.52-5.63, $p = 0.001$)

Discussion

The study sought to understand the knowledge of COVID-19, safety practices and factors influencing safety practices among HCWs working with patients during the first and second waves of the COVID-19 pandemic in three southwest states in Nigeria. The study found that about six in ten HCW had good knowledge of COVID-19, which is less than about 9 in 10 HCWs reported in an earlier Nigerian study. [20]

Table III: Safety Practices among healthcare workers during COVID-19 pandemic

Safety practices	Always n (%)	Very Often n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)
Use of recommended PPE when treating any patient in the general outpatient clinic (n = 210)	85 (40.5)	51 (24.3)	30 (14.3)	22 (10.5)	22 (10.5)
Handwashing after patient contact (n = 210)	141 (67.1)	60 (28.6)	9 (4.3)	0 (0.0)	0 (0.0)
Use of surgical mask while attending to patient (n = 210)	118 (56.2)	49 (23.3)	27 (12.9)	15 (7.1)	1 (0.5)
Experienced supervisors/senior colleagues' reprimand when no PPE use while treating patients (n = 210)	46 (21.9)	46 (21.9)	41 (19.5)	38 (18.1)	39 (18.6)
Use of recommended PPE when treating a suspected Covid 19 patient (n = 58)	36 (62.1)	8 (13.8)	4 (6.9)	2 (3.5)	8 (13.8)
Change gloves between patients when working with Confirmed patients (n = 13)	11 (84.6)	2 (15.4)	0 (0.0)	0 (0.0)	0 (0.0)
Use of recommended PPE when treating a confirmed case or a "possible case of COVID-19 with severe illness." (n = 13)	13 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Table IV: The relationship between healthcare workers' socio-demographics and safety practices

Variable	Safety Practice		Statistics χ^2 (df)	p-value
	Good Frequency (%)	Poor Frequency (%)		
Professional Cadre				
Doctor (n = 139)	93 (63.9)	46 (33.1)	$\chi^2 = 4.23$ df = 2	0.120
Nurse (n = 44)	24 (54.5)	20 (45.5)		
Others (n = 27)	21 (77.8)	6 (22.2)		
Gender				
Male (n = 103)	68 (66.0)	35 (34.0)	$\chi^2 = 0.01$ df = 1	0.930
Female (n = 107)	70 (65.4)	37 (34.6)		
Years of Experience				
0 - 10 years (n = 104)	72 (69.2)	32 (30.8)	$\chi^2 = 1.73$ df = 2	0.420
11-20 years (n = 92)	56 (60.9)	36 (39.1)		
21 years and above (n = 14)	10 (71.4)	4 (28.6)		
Type of facility				
FTH/FMC (n = 61)	41 (67.2)	20 (32.8)	$\chi^2 = 10.72$ df = 3	0.013
State TH (n = 61)	33 (51.6)	31 (48.4)		
Private/Mission hospital (n = 35)	29 (82.9)	6 (17.1)		
Others (n = 50)	35 (70.0)	15 (30.0)		
Availability of treatment/isolation protocol				
Yes (n = 132)	87 (65.9)	45 (34.1)	$\chi^2 = 0.005$ df = 1	0.946
No (n = 52)	34 (65.4)	18 (34.6)		
Availability of PPE guidelines				
Yes (n = 142)	94 (66.2)	48 (33.8)	$\chi^2 = 0.05$ df = 1	0.820
No or don't know (n = 42)	27 (64.3)	15 (35.7)		
Previous training on IPC				
Yes (n = 113)	84 (74.3)	29 (25.7)	$\chi^2 = 8.07$ df = 1	0.004
No (n = 97)	54 (55.7)	43 (44.3)		

FTH/FMC - Federal Teaching Hospital/Federal Medical Centre; State TH - State Teaching Hospital; PPE - Personal Protective Equipment; IPC - Infection Prevention and Control

Table V: Binary logistic regression analysis of the predictors of good safety practice among healthcare workers

<i>Variables</i>	<i>Odds Ratio</i>	<i>95 CI</i>	<i>P-value</i>
Cadre			
Doctors (Reference)	1		
Nurses	0.3	0.1-0.7	0.005
Others	0.9	0.3-2.7	0.79
Treatment protocol available			
No (Reference)	1		
Yes	1.7	0.8-3.5	0.19
Trained on IPC			
No (Reference)	1		
Yes	2.9	1.5-5.6	0.001
Knowledge of COVID-19			
Poor knowledge (Reference)	1		
Good knowledge	0.6	0.3-1.2	0.11
Facility type			
FTH/FMC (reference)	1		
State Teaching Hospital	0.4	0.2-0.9	0.031
Private/Mission	2.7	0.8-8.7	0.098
Others	2.1	0.7 - 5.8	0.17

Studies from Uganda and Ethiopia reported good knowledge in about 7 in 10 HCW [21,22], while a web-based global study reported only 4 in 10 had good knowledge of SARS COV2 transmission. [23] The vast difference between the present study and other studies may be due to the different standards of knowledge assessment and the extensive range of knowledge items covered by this study.

The proportion of HCW who had been trained on IPC (53.8%) is higher than 39.3%, and 47.8% reported to have been similarly trained in the southwest and northwest Nigeria respectively, [17,24] but less than 62.3% reported from a study in India. [25] The higher figure reported from India may be due to the prioritization of training for healthcare workers; more so, there is a higher rate of COVID-19 among the Indian population. Training of HCW is essential for many reasons, such as protecting themselves and their families from COVID-19 and prevention of transmission of COVID-19 in health care settings from HCW to a patient or from one patient to another.

The use of appropriate PPE by HCW in this study was recorded among less than a half, similar to another study in Nigeria which reported 44.9%, [26] but much less than 84.4% reported from India. [25] Poor epidemic preparedness and the widespread report of PPE shortages at the pandemic's start contributed immensely to the lack of PPE during the pandemic. [27] This could have contributed to the high burden of COVID-19 infection during the early phase of the pandemic. The level of knowledge of PPE use among HCW and perception of risk associated with COVID-19 could also have affected appropriate PPE use by HCW during the pandemic. The COVID-19 risk perception in Nigeria was low, even among HCW. [28]

The use of surgical masks among the respondents in this study (56.1%) was similar to 54% reported from a Ugandan study, [22] but less than 87% reported from Italy. [29] The use of facemask by HCW is a crucial safety practice because the surgical mask is cheap, easy to manufacture and widely available. Although the re-use of the surgical mask was observed during the pandemic

in many countries, this was mainly due to the shortage of PPE and should not be the norm because washing and re-use of facemask may reduce its protective ability against COVID-19. [14]

The overall prevalence of safe practices (65.7%) in this study is slightly higher than 57.2% reported in a previous Nigerian study, [30] but similar to 62% in Ethiopia, [21] and less than 74% reported from Uganda. [22] Safe practice varies widely across many facilities in many countries, but there are still gaps in Africa. This may be due to a lack of human resources for health and a weak health system that is not strong enough to ensure compliance with standard safety practices in health facilities. [31] These gaps need to be filled to improve the quality of care and prevent the transmission of infections among HCWs and patients alike.

The factors with significant association with safety practices in this study included the cadre, previous training and facility type. A cross-sectional survey of HCW in Nigeria had reported the facility type and gender as significant predictors of PPE use. [26] An Ethiopian study also reported IPC training and access to IPC guidelines as significantly associated with good COVID-19 behaviour. In contrast, another study from Uganda reported age and educational qualification of HCW as significantly associated with safety practices, but these variables were not significant in the present study. [22] The identified factor in each location identifies opportunities for designing IPC programs and prioritizing intervention groups. This study is limited because it may be prone to social desirability bias as HCWs may not volunteer the true extent of non-use of PPE and non-compliance with safety guidelines. Also, due to the small sample size, it may be difficult to generalize the findings to all healthcare workers in Nigeria.

Conclusion

The knowledge of COVID-19 among HCW is inadequate, which may affect their ability to practice safely against COVID-19. Many healthcare workers have not been trained on IPC, creating a huge capacity gap in the health system. The use of recommended PPE and the safe practices of HCW during the first wave of the COVID-19 pandemic was inadequate. HCW who were not doctors, practising in non-federal government-owned institutions, and lacking prior training in IPC were more predisposed to poor safety practices. It is recommended that all hospitals adopt the revised national IPC policy by the Nigeria Centre for Diseases Control to address the lack of IPC guidelines/policy in some facilities. Administrators of health institutions need to train and retrain HCWs across all cadres in all facilities on the use of PPEs to address widespread inadequate knowledge and prevent nosocomial transmission of COVID-19 and other emerging technologies re-emerging diseases.

Authors' Contributions: OTO, FO, and OA conceived and designed the study. BAO, AMA, and ATA participated in the study design. OTO, FO and BAO did literature review and data analysis. OTO, FO, BAO, AMA, and ATA did data interpretation and manuscript drafting. EOT participated in manuscript drafting. All the authors revised the manuscript for sound intellectual content and approved the final version of the manuscript.

Conflict of Interest: None.

Funding: Self-Funded.

Publication History: Submitted 06 January 2022; Accepted 16 March 2022.

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