



# Post-COVID-19 Evaluation of Information Systems Used in Rural Health Facilities in Delta State

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## ABSTRACT

The emergence of COVID-19 posed a lot of challenges to the rural communities in Nigeria. Nigeria is diversified, with a high concentration of elderly and teenagers in the rural areas. With a vulnerable population, rural communities are extremely important in terms of receiving Health Information (HI). This post-COVID-19 study investigated the use of information systems for the dissemination of health information in rural communities of Agbarho Kingdom of Delta State during the COVID-19 pandemic. A descriptive survey design using quantitative research with a questionnaire as the instrument for data collection was used for the study. The study focused on eight public and private hospitals in the Kingdom. The population of the study was 113 health personnel. The researchers adopted a face-to-face approach to administer the questionnaire directly to the available respondents within a period of one month (February 26 to March 25, 2024). Within that period, the researchers met 63 personnel who were on duty. Out of the 63, a total of 51 responded appropriately to the questionnaire that was used for the analysis. The data that was collected for this study were analyzed using Statistical Package for Social Sciences (SPSS) version 16.0. The study showed that the traditional method, the libraries and information systems were used by health professionals for the dissemination of HI to the rural people. The result also revealed that some health information was available to rural people during the COVID-19 pandemic. The challenges that hindered the dissemination of HI were highlighted. The health personnel in the health facilities in the rural communities in the kingdom participated in managing the spread of the COVID-19 pandemic. The study concluded that information systems, libraries and traditional methods were important means for the dissemination of health information to the rural people during the COVID-19 pandemic.

**Keywords:** Information Systems, Health Information Dissemination, Rural Health Facilities, COVID-19 Pandemic, Delta State

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## Introduction

Over the years, many countries of the world have suffered from the spread of contagious diseases, including Ebola, Flu, Chickenpox, Lassa fever, among others. For about three decades in a row, Ebola Virus Disease (EVD) has caused some damage to the health of people. EVD was identified in 1976, in almost simultaneous outbreaks in the Democratic Republic of Congo (DRC) and Sudan (now South Sudan) and was transmitted to people from wild animals and spreads in the human population through human-to-human transmission (World Health Organization, 2021; GOV.UK, 2023). Although, between 2014 and 2016, there was intense transmission in urban areas, resulting in over 28,000 reported cases in countries like Italy, Mali, Nigeria, Senegal, Spain, the UK and the US that imported EVD cases associated with the outbreak (GOV.UK, 2023). The spread of EVD was not as fast as the dreaded COVID-19 pandemic that led to the shutting down of most country's economic sectors. Just like Ebola that spread in several countries, the world in late 2019 witnessed yet another deadly disease known as COVID-19. On 11 March, 2020, COVID-19 was declared a pandemic by the World Health Organization (WHO), with a cumulative number of 124,101 confirmed cases around the world (Cucinotta & Vanelli, 2020). The first case of COVID-19 in Nigeria was reported on 27 February 2020 from an Italian who returned from Milan to Lagos on 25 February 2020 (Nigeria Centre for Disease and Control, 2020).

In Nigeria, some hospitals were designated as isolation centres for the treatment of COVID-19 patients. One of the closest centres to Agbarho Kingdom was the Federal University of Petroleum Resources, Effurun Health Centre. The Centre carried out sensitisation programmes and treated

patients with ailments. During the pandemic, the Federal Government of Nigeria imposed restrictions on the movement of persons across all the states to curb the spread of COVID-19. The order to restrict movement affected several communities, including Agbarho Kingdom. All public and private places where people usually gather in Agbarho Kingdom such as schools, libraries, markets and banks were partially closed and controlled. A 'controlled-temporary market' was created at the Agbarho Modern Primary School field to avoid the spread of COVID-19. Travelling within and outside the Kingdom for medical, educational and recreational activities was also restricted; hence the hospitals and libraries within the kingdom became the only source for health information (HI) for patients with health challenges. The 2015 United Nations Millennium Development Goals (UNMDGs) progress report showed that there is a wide gap between the richest and poorest people and between the rural and urban dwellers about nutrition, mortality, and access to HI. The rural people of Agbarho Kingdom are covered in the report of the UNMDGs. According to Gupta and Sinha (2010), there is a greater demand for accurate, relevant, rapid and impartial public health information for rural people and a growing reliance on the library, mass media and information systems as the main source of information.

The delivery of information in today's dynamic world requires some approaches to reach a target audience. Before the emergence of COVID-19, some conventional Health Information Systems (HIS) were used by health professionals for the dissemination of Health Information (HI) in most rural communities in Nigeria and other parts of the world. Such conventional HIS include posters, group discussions, handbills, market groups, family, friends and nationwide campaigns, among others. The spread of the COVID-19 pandemic created some challenges in the use of conventional HIS, including the library for HI dissemination to the rural people. The limitation of the conventional HIS during the spread of COVID-19 occasioned by restrictions on the movement of people necessitated the use of both conventional and modern HIS for the dissemination of HI to the rural

people. Modern HIS, such as the Internet, telehealth, bioinformation systems, radio and mobile phones, among others, help in generating data, accessing relevant information and facilitating health information sharing and consultation in rural communities. The adoption and use of both conventional and modern HIS for healthcare delivery in the COVID-19 era have been shown in some literature (Efe, 2013; EkoTeleMed, 2021; Meribole, et al., 2018). However, no study has been conducted on the use of HIS in rural communities of Agbarho Kingdom, Delta State, Nigeria. This study, therefore, reports the role of libraries and other health information and communication mediums in addressing information sharing during the COVID-19 pandemic in rural communities of Agbarho kingdom, Delta State, Nigeria.

### **Literature Review**

Several studies suggest that a wider variety of communication channels were used to reach out to rural communities (Anasi, 2012) including the use of mobile phones (Sokey et al., 2018) in Ghana, with the rural users appreciating the services to help them with health problems (Anie, 2011). There is evidence of the use of leaflets, posters, billboards, and interpersonal channels like doctors, community health workers, family, friends, town criers, and group discussions for the dissemination of HI in rural communities (Omeluzor et al., 2022; Sokey et al., 2018). In 2018, Orion Health drafted a proposal on how technology can benefit healthcare in rural communities. The proposal highlighted the importance of Electronic Health Records (EHR) for the management of patients' information, including health issues, lifestyle and habits. The study showed the relevance of EHR on population health management and enables healthcare personnel to view a patient's medical history no matter where they are located (Orion Health, 2018). An investigation into the dissemination of health data in Africa demonstrated that numerous African nations used distinctive techniques such as print, broadcasting and oral communication to share health information in rural communities (Anasi, 2012; Sokey et al., 2018).

Similarly, another study by Anie (2011) showed that 62.11% and 30% of the respondents admitted that the information they received through mobile communication, films, radio, television, VCD and CD-R affected their health education and decisions about their family health. Research showed that standardised procedures can be used on mobile phones to improve the dissemination of health information to rural people. Such standardization would delineate health information dissemination processes using technology at different steps for efficiency in rural areas (Singh et al., 2011). Also, respondents who participated in a study in rural communities of Windhoek indicated that they would like to receive Short Message Service (SMS) regarding health information from their rural health centres (Iyawa & Coleman, 2015). Mobile phone and web interfaces have also enhanced remote monitoring and provision of HI to diabetic and hypertensive patients (Agarwal & Lau, 2010). A comparative study on the use of SMS and voice for the evaluation of different mediums of collecting patients' data for effective healthcare delivery showed some level of accuracy and efficiency in the use of mobile phones (Patnaik et al., 2009). The study also revealed that surveillance systems, the Internet of Things (IoT), Artificial Intelligence (AI), mobile phones, bioinformatics and robotics were used to combat COVID-19 outbreak (Asadzadeh, et al., 2020). Similarly, an investigation in China on web-based services such as WeChat, cloud computing, IoT, AI, 5G telemedicine and clinical information systems were used to facilitate clinical management for the COVID-19 pandemic (Ye et al., 2020).

Accessing health information became more complex in Nigeria during the COVID-19 pandemic due to inadequate ICT infrastructure in rural communities. There is evidence that ICT has penetrated the educational and banking sectors (Aupal & Oleja, 2017; Alone, 2008), but the health sector has yet to receive such a gesture. About 70% of the inhabitants living in rural communities in Nigeria were yet to attract sufficient health projects that could substantially improve their health needs (Efe, 2013). The huge gap in ICT infrastructure between the urban and rural dwellers in Nigeria

remains a challenge in the delivery of HI to the rural people (Efe, 2013). In the absence of ICT infrastructure in the rural communities, local media such as town crier, local newspapers, market associations, handbills, and drama presentations could be used to convey critical HI to the rural people (Omeluzor et al., 2017). The study by Iornenge (2020), Suttle (2017) and Sokey et al (2018) revealed that too much concentration of medical personnel in the urban areas to the neglect of the rural areas, unavailability of modern health information systems, inappropriate media, inadequate mobile network connectivity, inadequate infrastructure, and lack of training and sensitization were some of the factors hindering the development of HI in the rural areas.

Nigeria has a spread of libraries including academic libraries, special libraries and the public library. In Delta State, sixteen public libraries are located at local government headquarters, far away from the rural communities (Omeluzor et al., 2017). The libraries in Nigeria (public and academic) are making a significant impact on the lives of their users through the provision of relevant information services. Studies have shown the relevance and the dependence of students, teachers and researchers on the library for health information (Omeluzor et al., 2013). During the COVID-19 pandemic, the librarians under the aegis of the Nigeria Library Association (NLA) organized a series of webinars and symposiums to sensitise its members and the public on fake news and misinformation on COVID-19 pandemic. In addition, some libraries and state chapters of NLA also donated hand sanitisers, posters and flyers to some rural communities as a means of curbing the spread of COVID-19 (Omeluzor et al., 2022). The librarians also played some major roles during the pandemic, including assisting users in solving their queries, disseminating selective information and current awareness, facilitating access to links to open access, creating awareness by sensitizing the public on general hygiene as a measure to curtail the spread of COVID-19 pandemic (Alabi & Sani, 2021; Omeluzor et al., 2022). The public libraries in Nigeria lack some necessary equipment, modern technologies and current information resources for

the effective dissemination of health information to the rural people in Nigeria (Omeluzor et al., 2017). During the COVID-19 pandemic, the library was almost inaccessible to the people because of inadequate ICT facilities to disseminate information to the library users (Omeluzor et al., 2022). The challenge of the inaccessibility of HI via technology was not peculiar to the rural people in Nigeria. Evidence in the literature showed that the 2020 broadband deployment report of the Federal Communication Commission (FCC) in America had approximately 22.3% of rural residents and 27.7% of Americans in the rural areas that did not have access to fixed broadband services in 2018. In Nigeria, some of the rural communities were without basic amenities such as electricity and Internet access that could enhance the dissemination of HI during the COVID-19 pandemic (Iornenge, 2020). Again, Nigeria is facing a migration of medical personnel who are leaving in search of greener pastures abroad (Adebowale-Tambe, 2022). Similarly, the National Association of Resident Doctors (NARD) of Nigeria reported that “85% of doctors were planning to leave Nigeria” (Adejoro, 2023). These scenarios are affecting the delivery of HI to rural people in the developing countries of the world (Iornenge, 2020; Efe, 2013).

However, the launching and use of an Online Medical System (OMS) that enhances Telehealth in Nigeria is changing the dissemination of HI to the people. OMS help patients to consult with a doctor in their preferred language, including English, Yoruba, Igbo and Hausa. Currently, Baba Telehealth in Delta State and Eko Telehealth in Lagos State are improving the delivery of HI to the people. The Baba Telehealth and Eko Telehealth are essential mediums for a collective fight against epidemics such as COVID-19 in Nigeria. Telehealth uses ICT tools such as telephone, audio, video conferencing and dashboards for patients’ health examination, among others (Eko, 2021). According to Baba Telehealth, ailments such as Sinus infection, Sore throat, Cold and flu and skin conditions, among others, can be treated with 24/7 care services. Baba Telehealth connects and allows patients to meet qualified medical personnel from their homes and prime doctors and clinical healthcare to deliver

faster care, more convenient, affordable care and better satisfaction (Baba Telehealth, 2023). Be that as it may, this post-COVID-19 study evaluates information systems used in rural health facilities for the dissemination of HI in the rural communities of Agbarho Kingdom of Delta State, Nigeria, during the pandemic era. The three specific objectives that guide the study are to:

1. Find out the availability of information systems for the dissemination of health information (HI) in the rural communities of Agbarho Kingdom during COVID-19 era;
2. Find out the information systems that were used for the dissemination of HI to the rural people of Agbarho Kingdom during the COVID-19 era; and
3. Identify the challenges militating against the dissemination of HI in the rural communities of Agbarho Kingdom during the COVID-19 era.

## **Methods**

### *Research Approach*

This study adopted a descriptive survey design. The descriptive survey design is reliable and flexible to provide results from data collected for this study.

### *Study Setting*

The Agbarho kingdom is an ancient town located in Ughelli North Local Government Area and one of the most populated towns in Delta State, Nigeria, with an estimated population of about 500,000 people (Wikipedia, 2021). The Kingdom is accessible through the Port Harcourt – Benin Expressway and a few kilometres away from Effurun and Osubi Towns. Agbarho Kingdom has two complimentary sub-clans – Awvedjan and Okparegbe. Among the two sub-clans are several communities (Nigeria Galleria, 2021). Because of the warm hospitality of the indigenous people of the kingdom, many people were residing at Agbarho, thereby affecting the population growth. With a densely vulnerable population comprising children, adolescents and aged people, there is the tendency of an upsurge of epidemic diseases such as COVID-19 without adequate HI for the people who are a mix of artisans, businessmen and

women, scholars, farmers, civil servants and professionals in various fields of human endeavour. Before the public hospital was established in Agbarho, the rural people did not have access to modern health services. In 1975, the Federal Government established a public health facility in Agbarho kingdom. Between 1997 and 1998, one public and two private hospitals were established. Furthermore, between 2019 and 2021, four more private hospitals were established that use modern health information systems for HI. In the course of this study, there were eight hospitals, including two public and six private (see Appendix 1, Table 1), that provide HI to rural people. With an increasing number of hospitals in the Kingdom, one can infer that there is an improvement in the health sector compared to the past two decades (1975 – 1996) when there was only one public health facility that served the Kingdom.

#### *Population*

The population of this study is comprised of all the medical personnel and healthcare givers in all the registered public and private health facilities that were established and functional before January 2020 in Agbarho Kingdom. Because of the larger number of health facilities in Delta State, a convenience sampling method was used to select Agbarho Kingdom because of its strategic location in Ughelli-North Local Government Area. Agbarho Kingdom comprises several communities with several public and private hospitals that are capable of providing HI during COVID-19. During the period, there were eight registered health facilities in Agbarho Kingdom (see Table 1). Of the eight hospitals, five of them participated in the dissemination of HI during COVID-19 pandemic era, while three, including EVAGOLD, GraceVilla and SHABACH, did not participate and were excluded from the study. From a total population of 113 health personnel from the five hospitals, as shown in Table 1, all were used as samples for this study. Using the entire sample would give a good representation and acceptable result since none of them was excluded.

#### *Development of Research Instrument and Testing*

The study used a quantitative method for data collection using a questionnaire. The questionnaire had four (4) sections, labelled as sections A to D. It has questions with a 4-scale rating where 4 is the highest and 1 is the lowest, which applies to sections B, C and D. The questionnaire was developed by the researchers to provide answers to the three research objectives. Before the administration of the questionnaire to the respondents, the instrument was presented to an expert at the Department of Library and Information Science at Ignatius Ajuru University of Education, Port Harcourt, Rivers State, who made some corrections and modifications, resolved some defects and validated the questionnaire. To ensure the reliability of the structured questionnaire, a pre-reliability test was conducted by administering the questionnaire to 10 medical personnel who worked in one of the registered hospitals at Ughelli Town, which was not part of this study. The 10 questionnaires were all retrieved and analyzed using the Cronbach Alpha correlation coefficient at 0.50 level of acceptance, which gave a result of  $r = 0.84$ .

#### *Distribution and Data Collection*

The researchers adopted a face-to-face approach to administering the questionnaire directly to the available respondents within a period of one month (February 26 to March 25, 2024). Within that period, the researchers met 63 personnel who were on duty. Out of the 63, a total of 51 responded appropriately to the questionnaire. Data collected for this study were analysed using Statistical Package for Social Sciences (SPSS) version 16.0, and results are presented using frequency, tables and percentages for clarity and understanding.

## Results

Table 1: established hospitals, year of establishment, ownership, number of health personnel and their participation in the delivery of HIC during the COVID-19 pandemic.

Hospital	Year of est.	Ownership/ Type	Doctors	Nurses	CHA	Pharm acists	Pharm. Tech.	PHO	Delivery of health info in COVID 19 era	Remarks
Government Hospital, AGBARHO	1975	Govt. owned Public Hospital	8	32	7	4	1	3	√	Included
ARANU Clinic/ Maternity	1997	Private Clinic	2	4	3	2	-	2	√	Included
ELEHO Clinic/ Maternity	1997	Private Clinic	2	4	3	2	-	-	√	Included
Government Hospital, EHWERHE	1998	Govt. owned Public Hospital	2	16	2	2	-	-	√	Included
VICOGA Clinic/ Maternity	2019	Private Clinic	2	10	-	-	-	-	√	Included
EVAGOLD Clinic and Maternity	2020	Private Clinic	-	1	1	-	-	1	Nil	Excluded
SHABACH Clinic/ Maternity	2020	Private Clinic	2	-	-	-	-	-	Nil	Excluded
GRACEVILLA Clinic and Maternity	2021	Private Clinic	1	2	-	-	-	-	Nil	Excluded

Note: CHA - Community Health Assistant; PHO - Public Health Officer; Pharm. Tech. – Pharmacy Technician

The result in Table 1 reveals that eight health facilities were established between 1975 and 2021 before and during the COVID-19 pandemic in Agbarho Kingdom. Four of the facilities were newly established between 2019 and 2021, which signifies an improvement. Among the facilities are two ‘public hospitals’ located at Agbarho and Ehwerhe communities that were established in 1975 and 1998 and owned by the government. As shown in Table 1, there were ten medical doctors and a chief medical director who supervised the two facilities. In addition, there were forty-eight nurses, two CHA and two pharmacists in the two public health facilities, with one pharmacy technician at Agbarho Hospital. There were

three PHOs at Agbarho and none at Ehwerhe. The result in Table 1 further shows that six of the hospitals were privately owned, three of which were included in this study with six doctors, eighteen nurses, six CHA, four pharmacists, one pharmacy technician, and two PHO.

Table 2: availability of information systems in rural health facilities of Agbarho Kingdom in COVID-19 era in Nigeria.

Information system	Much available	Available	Rarely Available	Unavailable
	f (%)	f (%)	f (%)	f (%)
TeleMed system	-	10 (19.6)	1 (2)	40 (78.4)
Telehealth system	-	10 (19.6)	1 (2)	40 (78.4)
Electronic Health Record System (EHRS)	19 (37.3)	6 (11.8)	2 (3.9)	24 (47.1)
Bioinformatics system	-	18 (35.3)	1 (2)	32 (62.7)
Artificial Intelligence (AI)	-	-	-	51 (100)
Robotics	-	-	-	51 (100)
Wechat	-	-	11 (21.6)	40 (78.4)
Internet of things	-	-	-	51 (100)
Surveillance System	8 (15.7)	-	-	43 (83.4)
Website (Internet)	-	2 (3.9)	-	49 (96.1)
Mobile telephone	49 (96.1)	-	-	2 (3.9)
Radio	49 (96.1)	2 (3.9)	-	-
Film	-	2 (3.9)	-	49 (96.1)
Television	4 (13.7)	34 (66.7)	5 (9.8)	5 (9.8)
Library	3 (5.9)	9 (17.6)	7 (13.7)	32 (62.7)
Poster/Bill board	8 (15.7)	17 (33.3)	13 (25.5)	13 (25.5)
Handbill/leaflet	2 (3.9)	5 (9.8)	10 (19.6)	34 (66.7)
Interpersonal channel	3 (5.9)	5 (9.8)	5 (9.8)	38 (74.5)
Community health workers	27 (52.9)	23 (45.1)	1 (2)	-
Family/friends	49 (96.1)	2 (3.9)	-	-
Town crier	34 (66.7)	5 (9.8)	5 (9.8)	7 (13.7)
Group discussion	3 (5.9)	10 (19.6)	7 (13.7)	31 (60.8)
Oral communication	22 (43.1)	16 (31.4)	6 (11.8)	7 (13.7)
VCD/CD-ROM	2 (3.9)	4 (7.8)	10 (19.6)	35 (68.6)
Local Newspaper	38 (74.5)	4 (7.8)	6 (11.8)	3 (5.9)
Market group	-	-	23 (45.1)	28 (54.9)
Notice board	24 (47.1)	9 (17.6)	18 (35.3)	-

The result in Table 2 reveals that 19.6% of the respondents indicated that TeleMed and Telehealth systems, respectively, were available, while the majority, or 78.4%, indicated that they were unavailable. The result also shows that 49.1% of the respondents agree that EHRS was available, while 47.1% indicate that it was unavailable. The result further reveals that 35.2% of the respondents showed that a bioinformatics system was available, while 62.7% indicated that it was unavailable. The result also shows that 100% of the respondents

indicated that AI and robotics were unavailable, while 78.4% and 21.6% said WeChat was rarely available or unavailable. Another majority, or 100% of the respondents, indicated that the Internet of Things was unavailable. The result also shows that 83.4% and 96.1% of the respondents indicated that surveillance systems and websites (internet) were not available. Evidence from the result shows that 96.1%, 62.7%, 66.7%, 74.5%, 60.8%, 68.6%, and 54.9% of the respondents indicate that film, library, handbill/leaflet, interpersonal channel, group

discussion, VCD/CD-ROM, and market group were unavailable during the COVID-19 pandemic. On the other hand, the result reveals that 37.3% of the respondents indicated that EHRS was much available. It also shows that 96.1% signify that mobile telephones and radios were available respectively. The result further shows that 49% of the respondents specified that posters/billboards were available. The result also reveals that 98%,

96.1 and 66.7% of the respondents indicate that community health workers, family and friends and town criers, respectively, were available. The result in Table 2 further reveals that 74.5%, 82.3%, and 64.7% of the respondents, respectively, indicate that oral communication, local newspapers, and notice boards were available during the COVID-19 pandemic.

Table 3: information systems used for the dissemination of health information during the COVID-19 era

Information system	Highly used	Used	Rarely used	Not used
	f (%)	f (%)	f (%)	f (%)
My health facility uses TeleMedicine system to disseminate health information during COVID-19 pandemic	-	9 (17.6)	18 (35.3)	24 (47.1)
My health facility uses Telehealth system to disseminate health information during COVID-19 pandemic	2 (3.9)	6 (11.8)	12 (23.5)	31 (60.8)
My health facility uses Electronic Health Record System to disseminate health information during COVID-19 era	-	6 (11.8)	-	45 (88.2)
My health facility uses Bioinformatics system to disseminate health information during COVID-19 era	-	3 (5.9)	-	48 (94.1)
My health facility uses Artificial Intelligence to disseminate health information during COVID-19 era	-	-	-	51 (100)
My health facility uses Robotics to disseminate health information during COVID-19 era	-	-	-	51(100)
My health facility uses WeChat to disseminate health information during COVID-19 era	-	-	-	51 (100)
My health facility uses Internet of Things (IoT) to disseminate health information during COVID-19 era	-	-	-	51 (100)
My health facility uses Surveillance System to disseminate health information during COVID-19 era	-	-	-	51 (100)
My health facility uses Website to disseminate health information during COVID-19 era	-	2 (3.9)	-	98 (92.1)
My health facility uses Mobile telephone to disseminate health information during COVID-19 era	-	15 (29.4)	-	36 (70.6)
My health facility uses Radio to disseminate health information during COVID-19 era	-	-	-	51 (100)
My health facility uses Film to disseminate health information during COVID-19 era	-	-	-	51 (100)
My health facility uses VCD/CD-ROM to disseminate health information during COVID-19 era	-	-	-	51 (100)



My health facility uses the library to disseminate health information during COVID-19 era	-	4 (7.8)	14(27.4)	33 (64.7)
My health facility uses Poster/Bill board to disseminate health information during COVID-19 era	-	2 (3.9)	-	49 (96.1)
My health facility uses handbill/leaflet to disseminate health information during COVID-19 era	-	2 (3.9)	-	49 (96.1)
My health facility uses interpersonal channel to disseminate health information during COVID-19 era	7 (13.7)	5 (9.8)	5 (9.8)	34 (66.7)
My health facility uses community health workers to disseminate health information during COVID-19 era	3 (5.9)	10 (19.6)	7 (13.7)	31 (60.8)
My health facility uses family/friends to disseminate health information during COVID-19 era	7 (13.7)	16 (31.4)	-	33 (54.9)
My health facility uses town criers to disseminate health information during COVID-19 era	6 (11.8)	12 (23.5)	2 (3.9)	31 (60.8)
My health facility uses group discussion to disseminate health information during COVID-19 era	5 (9.8)	8 (15.7)	1 (2.0)	37 (72.5)
My health facility uses oral communication to disseminate health information during COVID-19 era	37 (72.5)	8 (15.7)	1 (2.0)	5 (9.8)
My health facility uses local newspaper to disseminate health information during COVID-19 era	-	-	5 (9.8)	46 (90.2)
My health facility uses market group to disseminate health information during COVID-19 era	-	3 (5.9)	18 (35.3)	30 (58.8)
My health facility uses notice board to disseminate health information during COVID-19 era	44 (86.3)	-	5 (9.8)	2 (3.9)

The result in Table 3 shows that only 17.6% and 15.7% of the respondents used telemedicine and telehealth systems respectively, while 35.3% and 23.5% rarely used them. It also shows that the majority or 47.1% and 60.8% of the respondents, did not use the systems. The result also shows that 88.2% and 94.1% of the respondents indicated that EHRs and bioinformatics systems were not used during the COVID-19 pandemic. The result indicated that 100% of the respondents specified that AI, robotics, WeChat, IoT, and surveillance systems, respectively, were not used to disseminate health information during the COVID-19 pandemic. The result shows that 92.1% indicated that websites were not used to disseminate information. It is evident in Table 3 that a lower percentage (29.4%) of the respondents used mobile telephones, while 70.6% did not use them to disseminate information. The results in Table 3 further reveal that 100% of the respondents did not use radio, film, and VCD/CD-ROM, respectively, to disseminate

information during the COVID-19 pandemic. It also shows that 27.4% rarely used the library, while 64.7% did not use the library to disseminate information. The result also shows that 96.1% of the respondents did not use posters/billboards/handbills/leaflets to disseminate COVID-19 information. The result also shows that 66.7%, 60.8%, 54.9%, 60.8%, and 72.5% of the respondents did not use interpersonal channels, community health workers, family and friends, town crier, or group discussion to disseminate information during COVID-19 pandemic. The result shows that 72.5% and 15.7% of the respondents highly used oral communication to disseminate health information during the COVID-19 pandemic. The result further reveals that 90.2% and 58.8% of the respondents indicate that local newspapers and market groups were not used to disseminate health information during the COVID-19 pandemic.

Table 4, challenges that militate against the dissemination of HI during COVID-19 era.

Challenges	SA	A	SD	D
Inadequate ICT infrastructure in rural health facilities	6 (11.8)	34 (66.7)	11 (21.6)	-
Poor network for mobile communication	22 (43.1)	13 (25.5)	6 (11.8)	10 (19.6)
Inadequate training in the use of information technology tools	3 (5.9)	34 (66.7)	9 (17.6)	5 (9.8)
Inadequate computer in rural health facilities	1 (2.0)	25 (49.0)	7 (13.7)	18 (35.3)
Inadequate mobile network provider	-	8 (15.7)	1 (2.0)	42 (82.4)
Inadequate mobile telephone in health facilities	9 (17.6)	-	24 (47.1)	18 (35.3)
Poor electricity supply		8 (15.7)	1 (2.0)	42 (82.4)

The results in Table 4 reveal that the majority or 77.9%, and 68.6% of the respondents strongly agree and agree that inadequate ICT infrastructure in rural health facilities and poor networks for mobile communication were challenges. Another 72.6% and 51% of the respondents strongly agree and agree that inadequate training in the use of information technology tools and computers in rural health facilities were challenges militating against the use of ICT tools for HI dissemination in the rural communities. This means that those challenges were hindrances to the dissemination of information during the COVID-19 pandemic in rural communities in Nigeria. In addition, the result in Table 4 also shows that 84.4%, 82.4%, and 84.4% of the respondents strongly disagree and disagree

that inadequate mobile network providers, inadequate mobile telephones in health facilities, and poor electricity supply were challenges hindering the dissemination of HI in the rural communities during the COVID-19 pandemic. These results imply that those factors were not hindrances to the dissemination of information during the COVID-19 pandemic.

### Discussion of Findings

The findings show that five health facilities were established before the COVID-19 pandemic, while an additional three were established in Agbarho Kingdom. The finding reveals that the number of health professionals, including, doctors, nurses, CHAs, PHOs and pharmacists were inadequate considering the 2016 World Health Organization's workforce requirements for universal health coverage and the SDGs result, which stipulated an "SDG index threshold" of 4.45 doctors, nurses, and midwives per 1000 population as an indicative minimum density representing the need for health workers. The findings confirm the report by Dal-Poz, Kinfu, Dräger and Kunjumen (2007), which showed an imbalance in the distribution of health personnel in 29 of the 46 countries in Africa, including Nigeria, that have fewer than 12 healthcare providers per 10,000 inhabitants. It also highlights the report by Adebowale-Tambe (2022), who reported that Nigeria is losing medical professionals who migrated to other countries in search of greener pastures. Also, Adejoro (2023) emphasized that "85% of medical doctors were planning to leave Nigeria." This finding implies that it may hurt the staff strength needed for sensitization, education, and dissemination of HI for the management of contagious diseases such as the COVID-19 pandemic in rural communities or related disease outbreaks.

The findings in Table 2 reveal that advanced information technologies such as TeleMed systems, Telehealth systems, AI, Robotics, WeChat, Internet of Things, Surveillance systems, Websites, and the Internet were not available at the health facilities during COVID-19. The finding is synonymous with the findings of Efe (2013) and Sokey et al. (2018), who lamented the absence of advanced

information technologies in rural communities of Ghana and Nigeria. The findings further show that mobile telephone, radio, television, and poster/billboards, which were mostly used for dissemination of information in the rural communities, were available, including community health workers, family and friends, town-crier, local newspaper, and notice board, which were mostly found in the community. The use of traditional HIS has been acknowledged in several kinds of literature, for instance: Omeluzor et al. (2017); Sokey et al. (2018). The study also shows that there was inadequate and unavailability of some information systems and traditional channels that could have enhanced the dissemination of HI to rural people during the COVID-19 pandemic. Traditional media may benefit the rural people to quickly receive information on the COVID-19 pandemic using the closest means and local language. The unavailability of HI during a crisis may hinder the dissemination of health information to the rural people, which may be a result of restrictions on movement imposed by the government.

The findings in Table 3 show that most of the information systems such as TeleMed, EHRS, Bioinformatics, AI, Robotics, WeChat, IoT, and Surveillance systems, among others, were not used at the health facilities during the COVID-19 pandemic. The findings indicate that most of them were generally not used, while some were partially used by a lower percentage of the respondents. The findings show that oral communication, local newspapers, and market groups were used to disseminate health information to the rural people. The finding substantiates the findings of Omeluzor et al. (2017), which showed that local newspapers and notice boards were used to enhance the dissemination of HI in rural communities. There is evidence in Table 3 that a lower percentage, or 29.4%, of the respondents used mobile phones for the dissemination of HI to the rural people. This percentage may be due to a poor network. Mobile phone is a faster and more cost-effective medium to disseminate information to people. Optimization of mobile communication would benefit both the health personnel and the

rural communities to easily communicate and access HI during a crisis such as the COVID-19 pandemic. Furthermore, the finding in Table 3 shows that the respondents used the library for the dissemination of HI to the rural people which indicated the importance of the library as a source of information to the general public. This finding corroborates the findings of Omeluzor et al. (2017) and Omeluzor et al. (2013), who emphasized the significance of the library as a source of reliable, relevant, and current information.

In Table 4, the findings reveal some of the challenges that affected the dissemination of HI during the COVID-19 pandemic. The finding indicates that inadequate ICT infrastructure at the health facilities was a major challenge. Observation showed that a number of the facilities that were visited did not have adequate ICT facilities such as computer and Internet access. The result substantiates the findings of Efe (2013) and Sokey et al. (2018), who reported the inadequacy of ICT infrastructure in rural communities of Nigeria. The findings imply that the dissemination of health information may be hindered in rural communities. The findings also show that inadequate training was a challenge for the dissemination of health information, as indicated by a significant percentage (72.6%) of the respondents. Training of health workers on the use of ICT tools is necessary for the dissemination of HI to the rural people. The result substantiates the findings of Oyovwe-Tinuoye et al. (2021), which showed that training on ICT skills engenders improvement in service delivery, efficiency, and job performance. The implication of inadequate training of health personnel may lead to unethical use of tools for healthcare delivery that may be harmful to the rural people. The findings in Table 4 further show that inadequate mobile network providers, inadequate mobile telephones in hospitals, and poor electricity supply were less of a challenge facing the dissemination of HI in rural communities.

### **Limitation**

This study was limited to fifty-one health professionals at the eight health facilities within Agbarho Kingdom. The number of respondents was

limited to fifty-one because of the peculiar nature of the health profession, which observes shift duty. The data collected and analyzed in this study were from the smaller number of health professionals on duty. A study of more respondents using qualitative methods might produce different results and provide additional information.

## Conclusion

Based on the findings, the study concludes that traditional and modern methods of health information systems are necessary for managing the spread of the pandemic in the rural community. The study showed that traditional methods were utilized for the dissemination of HI to rural people compared to the use of modern technologies. Rural communities comprising people of all ages are vulnerable and prone to diseases; hence, using modern technologies and traditional methods in making HI available to them through the health facilities and library during the crisis would help in reducing health risks and the spread of contagious diseases such as COVID-19. The traditional mediums and the library are closer to the rural people and should be explored irrespective of the challenges affecting the dissemination of HI in rural communities. The findings reveal that the health personnel showed some level of commitment and resilience in using available HIS to support patients despite the challenges they faced. The numerous challenges facing the dissemination of HI in rural communities, as revealed in this study, would need appropriate coordination and synergy among stakeholders in the Nigerian health and educational sectors and other parts of the world to improve the dissemination of HI to the rural people during a crisis such as COVID-19 pandemic.

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