



# Introduction

**H**Health is a catalyst for sustainable development as enshrined in the sustainable development goals. The UN 2030 Sustainable Development Goals (SDG) reflects the increasing connection of good health and Information and Communication Technologies. The 2019 International Conference on Information Technology and Economic Development (ICITED) convened its annual international conference (ICITED) under the theme, *Information & Communication Technology for Sustainable Development—UN Goal 3 (Health and Wellbeing)*. The international conference brought an array of participants, stakeholders and researchers from the health and information technology sectors among others. Most participants were from Nigeria but there were also participants from United Kingdom, Ireland, Greece, South Africa and Mexico. The conference attracted 43 submissions, 40 of which were accepted after blind reviews. Eventually, 24 papers authored by 95 researchers were registered and presented. They were organised under the following themes that reflected Goal 3 (Health and Wellbeing), apart from 3 presentations that fell under General theme:

- a) ICT and reducing the global maternal mortality;
- b) ICT and reducing deaths and injuries from road traffic accidents;
- c) ICT and achieving universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all;
- d) ICT and universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes;
- e) ICT and strengthen the capacity of all countries, for early warning, risk reduction and management of national and global health risks;
- f) General ICT and Health;
- g) ICT and research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health;
- h) ICT and health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries;
- i) ICT and ending the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases;
- j) General.

Moreover, there was a very interesting keynote address by Dr Kashifu Inuwa Abdullahi, the Director General of the Nigerian Information Technology and Development Agency (NITDA) and lead paper by Professor Tukur Dahiru on *ICT for Health System Strengthening*.

The participants enjoyed discussions of the problems, fears and prospects encountered by nations, communities and agencies in adopting ICTs for improving health and wellbeing. They also shared in the discussion of socio-technical dynamics of ICT adoption

and use for accomplishing Goal 3 of the sustainable development goals (health and wellbeing).

This book of abstracts will be of interest to new and prospective researchers who may be seeking a niche. Mature researchers can directly use information herein to expand their work. Besides, interested researchers can directly contact the authors for more information and collaboration.

# Acknowledgement

I am very grateful to the Vice-Chancellor, Professor Mohammed Tanko, of Kaduna State University (KASU) for permitting the hosting of the conference at his institution. The contributions of Professor Abdullahi Musa, the University Librarian, and his team are also acknowledged. The quality of the work would not be as good were it not for the diligent work of reviewers. I appreciate their contributions as well as those of Dr Kashifu Inuwa Abdullahi, the Director General of the Nigerian Information Technology and Development Agency (NITDA) and Professor Tukur Dahiru who delivered the keynote and the lead paper respectively. The authors cannot be forgotten for submitting, correcting and presenting their work for the conference. Some of them also had to do further corrections for this book.

Professor Abel Usoro

<https://orcid.org/0000-0002-9640-7598>

Conference Chair

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**Global Mhealth: Use of mobile technology to prevent Global maternal mortality**

Abhdulhakeem Olorukooba, Lawal Amadu, Biliaminu Bola Lawal, Umar Muhammad Umar  
and Aminu Lawal

Ahmadu Bello University

Zaria, Nigeria

[abdulhakimquick@gmail.com](mailto:abdulhakimquick@gmail.com), [lawalkuki@gmail.com](mailto:lawalkuki@gmail.com), [lawalbiliaminub@gmail.com](mailto:lawalbiliaminub@gmail.com),  
[amarubdone@gmail.com](mailto:amarubdone@gmail.com) and [danmusaone60@gmail.com](mailto:danmusaone60@gmail.com)

Shamsudeen Yahaya, Jimoh Ibrahim and Bilkisu Nwankwo

Kaduna State University

Kaduna, Nigeria

[drshamsu1@yahoo.com](mailto:drshamsu1@yahoo.com), [drjim20032000@yahoo.com](mailto:drjim20032000@yahoo.com), and [bilkisunwankwo@gmail.com](mailto:bilkisunwankwo@gmail.com)

**Paper Type:** Secondary research

**Introduction:** Every day, about 830 women die due to complications of pregnancy and childbirth. Almost all these deaths occur in low-resource settings, and most could have been prevented. Maternal mortality rates in West Africa are among the highest in the world. One in every 30 Nigerian mothers die in childbirth compared with one in every 30,000 in Sweden. The utilization of smart phones, tablets, and 3G and 4G networks has transformed health communications and health service delivery. Mobile health (mHealth) encompasses the use of mobile telecommunication and multimedia into progressively mobile and wireless health care delivery systems and has the propensity to improve the lives of millions each year. The pervasiveness and penetration of mobile phones provide the opportunity to use mHealth for maternal and new-born care, especially in areas where there are poor resources for healthcare. There has been gaps in the current knowledge about the general state of mobile technology use in maternal health and how this is related to achieving the Sustainable Developmental Goals.

**Purpose:** This review was aimed at describing the role of mobile information and communication technology in preventing maternal mortality globally.

**Methods:** A methodical search of literature concerning use of Mhealth for maternal health care in 3 electronic databases - PUBMED, HINARI and Google Scholar - was conducted using Medical Subject Headings (MESH). Only information in the last 10 years (2010-2019) was abstracted. Information about how mobile information and communication technologies has been used to help prevent maternal mortality was obtained.

**Results:** We found numerous areas where mobile information and communication technology was used in providing various forms of maternal health, from data collection, analysis, health promotion to emergency medical responses. Mobile information and communication technology has been used to strengthen health insurance; in tracking pregnant women in remote communities; in strengthening training of medical workers by providing access to accurate and current information regarding health conditions and treatment as well as the latest ideas on treating particular problems.

From a clinical perspective, mobile technology has also been used to empower patients. Individuals no longer need to visit doctors' offices to be reminded to take medication. Instead,

mobile devices allow patients to receive personal reminders via e-mail, automated phone calls, or text messages.

**Conclusion:** There are a number of ways in which mobile telecommunication technologies help improve maternal care and aid in reducing maternal and infant mortality. The government at all levels should encourage the application of mobile devices in maternal healthcare delivery programs so as to achieve the Sustainable Developmental Goal 3.

**Keywords:** Mhealth, Maternal Mortality, Infant Mortality, Information Technology, Sustainable developmental goals.

## ICT and Reducing Global Maternal Mortality; the Kaduna Situation

Steven Bature, Joel Adze, Matthew Taingson, Amina Mohammed-Durosinlorun, Caleb Mohammed, Amina Abubakar and Lydia Airede

Department of Obstetrics and Gynaecology, Kaduna State University. Nigeria

[sbbature@gmail.com](mailto:sbbature@gmail.com), [joeladze@yahoo.com](mailto:joeladze@yahoo.com), [taingson@yahoo.com](mailto:taingson@yahoo.com), [ababdaze@yahoo.com](mailto:ababdaze@yahoo.com), [dr\\_caleb@yahoo.com](mailto:dr_caleb@yahoo.com), [aminalng@yahoo.com](mailto:aminalng@yahoo.com) and [airedelydia@yahoo.com](mailto:airedelydia@yahoo.com)

**Paper Type:** Empirical research

**Background:** Nigeria makes up 2.82% of the world's population. Yet, it is responsible for 10% of global maternal deaths. Maternal mortality ratio in Nigeria is estimated at 512 per 100,000 live births (NDHS 2018). Functional Civil Registration and Vital Statistics Systems (CRVS) are the preferred source of data for both death counts and causes of death (COD). However, CRVS is rudimentary in Nigeria and most developing countries. Consequently, maternal death figures are only estimates, and the causes and pattern of death are derived from few hospital studies and not representative of the whole population. In Kaduna State, the third most populous state in Nigeria, detailed data on maternal deaths was only obtainable from Ahmadu Bello University Teaching Hospital, Zaria. This presented a challenge in designing interventions to avert maternal death state-wide since: the exact number of deaths was not known, the medical causes of death were not identified, and the background factors associated with deaths that contributed to Type 1, Type 2 and Type 3 delays were only assumed.

**Purpose:** The aim of this paper was to determine whether ICT could be used to reduce maternal deaths in Kaduna State.

**Methods:** The cornerstone of the intervention to reduce maternal mortality by the use of ICT in Kaduna State was the implementation of the Maternal and Perinatal Death Surveillance and Response (MPDSR). From 2016, MPDSR was implemented in a total of 30 health facilities across the state - one teaching hospital and 29 secondary level health facilities.

MPDSR was made up of the following components:

- Details of all maternal and perinatal deaths in each health care facility were captured on a standardized template electronically.
- This data was then transmitted electronically to the State MPDSR central committee, where it was analyzed using SPSS, and the results then shared with all the health facilities, Ministry of Health and other stakeholders including UNFPA.
- Subsequently, action plans were developed quarterly by the health facilities to address problems identified as contributors to maternal deaths.

**Results:** All 30 facilities selected for the intervention currently report on maternal and perinatal deaths which has led to the recognition of the actual numbers and causes of maternal deaths in 30 health facilities in Kaduna State. Post-partum haemorrhage and eclampsia have been identified as the leading medical causes of death in Kaduna State. This finding led to the approval and funding of a budget line to procure misoprostol, a drug for prevention and treatment of post-partum haemorrhage, for the first time in Kaduna State. 250,000 doses of misoprostol were procured under the 2014 budget. In addition, better quantification of maternal deaths from haemorrhage led to the procurement of solar direct drive blood banks for tertiary and selected secondary health facilities in Kaduna State.

**Conclusion:** ICT has improved collection, collation and analysis of maternal death data in Kaduna State. Data obtained from ICT has been used to put in place interventions to prevent and treat post-partum haemorrhage, a major cause of maternal death in Kaduna State. The Kaduna State experience shows that ICT can be used to reduce global maternal deaths.

**Keywords:** Maternal deaths, Information and Communication Technology (ICT), Maternal and Perinatal Death Surveillance and Response

### **References**

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# Availability and Pregnant Women Perceived Importance of Preconception Care in Sir Yahaya Memorial Hospital Birnin-Kebbi: Implication to Information and Communication Technology

Yahaya Jafaru

Department of Nursing Science, College of Health Sciences, Federal University Birnin-Kebbi, Kebbi State, Nigeria

[jafaruyahaya2015@yahoo.com](mailto:jafaruyahaya2015@yahoo.com)

**Paper Type:** Empirical research

**Background:** Women with a preconception suboptimal health status are at higher risk of maternal and neonatal morbidity than other pregnant women are (Denison, Norwood & Bhattacharya, 2014). Preconception Care (PCC) is a behavioural, social and biomedical intervention to couples in preparation for conception for curbing individual and environmental factors contributing to poor pregnancy outcomes (World Health Organisation, 2013). PCC emphasises lifestyle modification, chronic health problems interventions and identifying risk of getting genetically malformed children (Dhavliker & Purohit, 2017). However, there is a considerable gap in provision of PCC (Annadurai, Mani, & Danasekaran, 2017); the availability of PCC is very limited and unsatisfactory (Salganicoff, Ranji & Wyn, 2005). Integrating PCC into healthcare services has been problematic (M'hamdi et al., 2016), and Information and Communication Technology (ICT) could be used in resolving the issue.

**Aim:** The aim of the study was to assess the availability and pregnant women perceived importance of PCC in Sir Yahaya memorial hospital Birnin-Kebbi, and to highlight the implication of findings to the design and development of information and communication technology.

**Methods and materials:** The study was descriptive that employed cross-sectional design. The respondents were pregnant women attending antenatal care (ANC) and selected healthcare personnel in obstetric and maternity units of the hospital. Two Likert Scale questionnaires were used in data collection, the questionnaire for pregnant women and the questionnaire for healthcare personnel. The calculated sample size was 173 and 46 for pregnant women and healthcare personnel respectively. However, 166 and 40 questionnaires respectively were retrieved. SPSS version 21 was used in data analysis and result was presented in percentages, with Chi square as a statistical tool.

**Findings:** Majority (29.9% and 44.9%) of pregnant women strongly disagree and disagree respectively to the availability of PCC. Most of the health personnel (17.8% and 25.9%) strongly disagree and disagree respectively to the availability of PCC. Majority (41.3% and 28.1%) of pregnant women agree and strongly agree respectively to the importance of PCC. There is no significant relationship between pregnant women demographic variables and their views on availability of PCC across all the variables,  $P > 0.05$ . There is no significant relationship between pregnant women demographic variables and their perceived importance of PCC across all the variables,  $P > 0.05$ . There is no significant relationship between years of experience of healthcare personnel and their views on availability of PCC,  $P > 0.05$ .

**Conclusion:** It is indispensably important for PCC unit to be provided in health centres. It is implied that ICT is a good means by which the information on PCC can be communicated to policy makers, healthcare personnel and healthcare consumers within short period of time. Thus, the long-standing lack of awareness and availability of PCC can be effectively resolved with ICT. This could lead to provision, more acceptance and utilization of PCC, thereby enhancing maternal and child healthcare and reduction in maternal and child morbidity and mortality.

**Keywords:** Pregnant, Birnin-Kebbi, Information and communication technology, Perceived importance, Preconception care.

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## A Case Study of the Use of ICT to Improve Maternal and Child Health Care by Village Health Workers in Northern Nigeria

Clement Woje, Farouk Adiri, Istifanus Joshua, Grace Nmadu, Namben Omole, Nafisat Usman and Jimoh Ibrahim

Department of Community Medicine,  
College of Medicine, Kaduna State University,  
Kaduna, Nigeria

[cwoje@yahoo.com](mailto:cwoje@yahoo.com), [adirifarouk@yahoo.com](mailto:adirifarouk@yahoo.com), [dristfanus@yahoo.com](mailto:dristfanus@yahoo.com),  
[jumainmadu@yahoo.com](mailto:jumainmadu@yahoo.com), [nvable110@yahoo.com](mailto:nvable110@yahoo.com), [just4nene@yahoo.co.uk](mailto:just4nene@yahoo.co.uk) and  
[drjim20032000@yahoo.com](mailto:drjim20032000@yahoo.com)

**Paper type:** Empirical research

**Background:** Mobile software technology application is an Information Communication and Technology (ICT) tool that was used to support Village Health Workers (VHWs) in providing home-based care to communities and vulnerable groups. It also served as a good tool for supervision and coordination of community health programs.

**Purpose:** The study aims to evaluate the effectiveness of the use of mobile phone software technology application to improve and provide access to early diagnosis, treatment and referral by Village Health Workers (VHWs) in Pampaida Millennium Villages Project in Northern Nigeria.

**Method:** In the project, VHWs were trained to use smart phone-based open source software which uses a cloud-based server and software called 'Commcare' to collect household data and community level patient information. The platform guides the VHWs through an electronic questionnaire to collect data on pregnancy, birth and condition of infants and their mothers (including the use of family planning) as well as other household data between the years 2009-2015. The platform also provided VHWs with instructions on management of malaria, malnutrition, diarrheal diseases and upper respiratory tract infections at the household level and referral to higher-level care. The data collected was used by the managers of the programme to monitor and supervise the VHWs.

**Findings:** The project villages had significant better health outcomes in nutrition as well as maternal and child health relative to the comparison villages. Fig. 1 shows U-5 (under 5s) Stunting to be 3% at the project villages as against 12% in the comparison villages. The outcomes were more significant in measles immunization – 75% coverage in project villages (0% in comparison villages); exclusive breast feeding – 75% project villages (31% in comparison villages); infant mortality rate – 24/1000 live births in project villages (123/1000 live births in comparison villages) and U-5 Mortality Rate – 48/1000 live births in project villages (203/1000 live births in comparison village), Fig. 2.

The maternal health indicators (Fig. 3) show significant favourable outcomes in the project villages relative to the comparison villages: skilled birth attendance of 81% in project villages (15% in comparison villages); modern contraceptive use 70% in project villages (0% in comparison villages); four antenatal care visits 97% (34% in comparison villages).

Finally, there was a 100% HIV testing in project villages (30% in comparison villages) and U-5 calaria prevalence of 15% (59% in comparison villages), Fig. 4.

Fig. 1

| <b>U-5 Nutrition indicators</b>   |                         |                            |
|---|-------------------------|----------------------------|
| <b>Outcome indicator</b>  | <b>Project villages</b> | <b>Comparison villages</b> |
| Under-5 Underweight   | 0.02(0, 0.04)           | 0.06(0.03, 0.0)            |
| Under-5 Stunting  | 0.03(0, 0.06)           | 0.12(0.08, 0.17)           |
| Under-5 Wasting   | 0.03(0, 0.07)           | 0.07(0.04, 0.1)            |
| Under-5 Anemia  | 0.21(0.11, 0.31)        | 0.67(0.57, 0.78)           |
| <i>Estimates from project villages were compared with comparison villages with 95% intervals of uncertainty for each outcome, presented on the raw scale of the data (rather than in standard deviations). Outcomes are in proportions and so range from 0 to 1</i> |                         |                            |

Fig. 2

| <b>Child health indicators</b>  |                         |                            |
|---|-------------------------|----------------------------|
| <b>Outcome indicator</b>  | <b>Project villages</b> | <b>Comparison villages</b> |
| Measles immunization  | 0.75(0.59, 0.91)        | 0(0, 0)                    |
| Exclusive breastfeeding   | 0.75(0.56, 0.94)        | 0.31(0.19, 0.43)           |
| Infant mortality (per 1000 live births)   | 24(9, 39)               | 123(90, 155)               |
| U-5 mortality (per 1000 live births)  | 48(21, 74)              | 203(161, 246)              |
| <i>Estimates from project villages were compared with comparison villages with 95% intervals of uncertainty for each outcome, presented on the raw scale of the data (rather than in standard deviations). Outcomes are in proportions and so range from 0 to 1</i> |                         |                            |

Fig. 3

| <b>Maternal health indicators</b>   |                         |                            |
|---|-------------------------|----------------------------|
| <b>Outcome indicator</b>  | <b>Project villages</b> | <b>Comparison villages</b> |
| Skilled birth attendance  | 0.81(0.71, 0.91)        | 0.15(.08, 0.21)            |
| Any contraceptive use   | 0.74(.64, 0.84)         | 0.01(0, 0.02)              |
| Modern contraceptive use  | 0.7(0.6, 0.81)          | 0(0, 0)                    |
| Skilled antenatal care visit  | 1(.99, 1)               | 0.53(0.33, 0.72)           |
| Four antenatal care visits  | 0.97(.94, 1)            | 0.34(0.16, 0.52)           |
| <i>Estimates from project villages were compared with comparison villages with 95% intervals of uncertainty for each outcome, presented on the raw scale of the data (rather than in standard deviations). Outcomes are in proportions and so range from 0 to 1</i> |                         |                            |

Fig. 4

| <b>HIV/AIDS and Malaria indicators</b> |                         |                            |
|--|-------------------------|----------------------------|
| <b>Outcome indicator</b>               | <b>Project villages</b> | <b>Comparison villages</b> |
| Pregnancy HIV testing                  | 1(0.99, 1)              | 0.3(0.12, 0.47)            |
| U-5 malaria                            | 0.15(0.08, 0.22)        | 0.59(0.49, 0.7)            |
| Women malaria                          | 0.15(0.04, 0.25)        | 0.5(0.38, 0.63)            |
| U-5 bednet use                         | 0.75(0.66, 0.84)        | 0.58(0.48, 0.67)           |
| Preg. Bednet use                       | 0.79(0.61, 0.97)        | 0.59(0.42, 0.75)           |
| Women Anemia                           | 0.22(0.08, 0.37)        | 0.62(0.54, 0.7)            |

*Estimates from project villages were compared with comparison villages with 95% intervals of uncertainty for each outcome, presented on the raw scale of the data (rather than in standard deviations). Outcomes are in proportions and so range from 0 to 1*

**Recommendations/Conclusion:** The significant health outcomes in the project villages with 95% uncertainty intervals in nutrition, maternal and child, as well as HIV and malaria indices, show that community members with basic knowledge in literacy and numeracy, who are empowered with ICT tools can increase access to and coverage to basic health services, thus improving health outcomes in children U5 and women of child bearing age.

**Conclusion:** The relevance of this study cannot be overemphasized. The potential of information and communication technology when integrated into a health program was demonstrated. When replicated in other settings, it will have the potential of enhancing maternal and child health services.

**Keywords:** Mobile software, Evaluation, Village Health Workers, Millennium Villages, Northern Nigeria.

## **Interface of Information and Communication Technology, Midwifery Continuity of Care and Reducing Maternal Mortality**

Yahaya Jafaru

Department of Nursing Science, College of Health Sciences, Federal University Birnin-Kebbi, Kebbi State, Nigeria

[jafaruyahaya2015@yahoo.com](mailto:jafaruyahaya2015@yahoo.com)

**Paper type:** Position paper

**Background:** The dramatic advances in Information and Communication Technology (ICT) have transformed the way in which health care professionals deliver patients care (Lupiáñez-Villanueva, Hardey, Torrent, & Ficapal, 2011). ICT enables nurses to find, interpret, organize and evaluate information from variety of sources for better decision-making and problem-solving within patients care (Lee, 2005). It includes all digital technologies that support the electronic capture, storage, processing, and exchange of information in order to promote health, prevent illness, treat disease, manage chronic illness, and so on (Bashshur et al., 2009; Gagnon et al., 2012). Midwifery Continuity of Care (MCC) are models of maternity care by a single midwife familiar to the woman, the primary midwife, back up by other colleagues. The primary midwife sees the woman consistently during pregnancy, labour and post-natal period and is supported by teams of specialists through referral (Sandall et al, 2016). In the current health care environment, nurses are challenged to incorporate ICT into their routine (Smedley, 2005). Despite these, the implementation of ICTs in nursing and midwifery practice remains difficult and involves changes at different levels, including with respect to patients, healthcare providers and healthcare organizations (Mair et al., 2012).

**Aim:** The aim of this paper is to showcase the interface of ICT, MCC and reducing maternal and infants' mortality.

**Method:** The paper is a position paper that used empirical and theoretical literary review to determine its aim.

**Findings:** The paper reveals domains of ICT in connection with MCC including the management systems, communication systems, computerized decision support systems (CDSSs) and information systems. It pinpoints the tele-communication and information in MCC, as healthcare is an information intensive industry, in which quality and timely information is a critical resource. The paper scaled down to discuss the relevant of telehealth in reducing maternal and infants' mortality by sharing health data and healthcare information between health personnel and patients. Telehealth is helpful in early identification of pregnancy emergencies like bleeding in pregnancy, leading to early intervention. It also shortens the frequent visit of pregnant women to hospital, reduce pregnant women hospitalizations and thus, cost-effective and economical. The paper also discusses the improvement of maternal safety, quality and efficiency of midwifery care with ICT.

**Conclusion:** It is concluded that Healthcare is information and relational dependent, and ICT is well known in improving information and providing relational supports among people. Most maternal and infant deaths can be prevented if proper maternity services are provided, and evidences from theoretical and empirical literatures show that ICT is highly vital and can be

used in that respect. Experienced and competent midwives are resource in providing maternal services before, during and immediately after pregnancy using ICT, through MCC.

**Keywords:** Communication technology, Continuity of care, Information, Interface, Maternal mortality, Midwifery

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## Information Sources and Access to Information on Maternal Health Services by Primigravida in Fatima Village in Zaria L.G.A Kaduna State

Maimuna Suleiman Ibrahim  
Ahmadu Bello University, Zaria, Nigeria  
[munat202@gmail.com](mailto:munat202@gmail.com)

Musa Katsayal Bako  
Federal University Birnin Kebbi, Kebbi State, Nigeria  
[musabako87@gmail.com](mailto:musabako87@gmail.com)

**Paper type:** Empirical research

**Background:** Motherhood is a very fulfilling experience to the mother and the family as a whole, but maternal mortality shatters that experience causing utter devastation to all. There is a high rate of maternal mortality in Nigeria especially in the rural areas of northern Nigeria, hence the interest in Fatima village. The research focused on primigravida (first time pregnant women or women that delivered their first babies and are less than forty-two days). While WHO has documented that utilization of maternal health services could reduce or avert maternal mortality and teenagers are the worst hit by maternal mortality, underutilization of maternal healthcare services in Fatima has been identified as a major problem.

**Purpose:** The study intends to investigate whether primigravida have access to reliable sources of information on maternal health services when they have information needs pertaining to pregnancy that could lead to utilizing the services.

**Research Questions:** To achieve this aim these research questions were formulated (a) What sources of information on maternal health services are available to primigravida in Fatima village of Zaria L.G.A of Kaduna state? (b) How do primigravida access information on maternal health service in Fatima village of Zaria L.G.A of Kaduna state? (c) What barriers hinder primigravida from accessing maternal health services in Fatima village of Zaria L.G.A of Kaduna state?

**Method:** The research approach used was phenomenology (hermeneutics) which investigates direct conscious experiences of phenomena as free as possible without theories, preconceptions and presuppositions. The population of the study is all reproductive women in Fatima village. Snowball sampling technique was used to find and recruit ten (10) primigravida who were willing to participate in the study in their natural settings. The instrument for data collection was in-depth semi structured interview. An iterative analysis method was employed for coding the narratives which were manually done which resulted into subcategories and categories.

**Findings:** The research found out that Primigravida accessed information on maternal health services through informal sources which are their social networks and believed maternal health service are services accessed when there is complication in delivery, Primigravida in Fatima also relied on traditional birth attendants (TBAs) to deliver their babies and believed that maternal health services are for the elite. Sources of information on maternal health services available to primigravida were their social network and it is the only source they have access to. A major barrier to access to maternal health service that this study revealed is that primigravida are not aware of the benefits of maternal health services: a primigravida refused going to the health facility to have her baby simply because her co-wife suggested it. The implication of these lack of awareness on benefits of maternal health services are making poor decisions, lack of information about hygiene and nutritious foods, proper check-up during prenatal, antenatal and postnatal visits that could avoid mortality.

**Recommendation:** The study recommends the use of information and communication technology (ICT) tools to design posters, graphic images etc by the ministry of health to disseminate information

on the benefits of maternal health services to primigravida in the rural areas and their social network which was dominated by men should be fully involved in all programs.

**Keywords:** Sources, information access, primigravida Fatima, material health services

## **The Role of Information and Communication Technology in Prevention and Mitigation of Road Traffic Accidents in Nigeria**

Istifanus Joshua, John Igboanusi, Grace Nmadu, Nafisat Usman and Adiri Farouk  
Kaduna State University  
Kaduna, Nigeria  
[dristifanus17@gmail.com](mailto:dristifanus17@gmail.com), [chineduofgod@gmail.com](mailto:chineduofgod@gmail.com), [jumainmadu@yahoo.com](mailto:jumainmadu@yahoo.com),  
[nenezego@gmail.com](mailto:nenezego@gmail.com) and [adirifarouk@gmail.com](mailto:adirifarouk@gmail.com)

Mary Onojaalexander and Charles Esekhaigbe  
Ahmadu Bello University  
Zaria, Nigeria  
[ibetule@yahoo.com](mailto:ibetule@yahoo.com) and [polomyfancy@gmail.com](mailto:polomyfancy@gmail.com)

**Paper type:** Secondary research

**Background:** Road transportation being the most popular mode of movement with added benefits is still a leading cause of morbidity and mortality in Nigeria.

**Purpose:** This paper is a narrative review of prevalence, causes and impacts of road traffic accident in Nigeria and the role Information and Communication Technology (ICT) could play in its prevention and mitigation.

**Method:** Literature searches of peer-reviewed articles between 2000 and 2019 in databases such PubMed, Medline, African Journals On line and Google scholar was conducted.

**Findings:** The results showed that an estimated 1.2 million people die each year in road traffic accidents (RTAs) and more than 50 million are injured worldwide. Nigeria continues to feature in the bottom half of World Health Organization (WHO) country rankings of RTA. The country's 149th ranking in 2009 out of 178 member states indicates the hazards associated with road transportation in a country mostly dependent on its road network for economic, social and physical activities. The causes of RTA could be divided into human, vehicular and environmental factors. However, about 80% of the causes are due to human factors, among which are uses of drugs, medical conditions, lack of training before driving, use of phones while driving. Daily alcohol consumption and eating of kola nut while driving was 11.5% and 48.4% respectively. Only about half had ever trained at a registered driving school, 3.7% had eye defects, 57.3% had previously been involved in auto-accident, 43.0% were habitual consumers of alcohol and alcohol is usually sold within or around the motor park. Road traffic accidents in Nigeria is a major public health challenge.

**Recommendation:** ICT tools such as Global Positioning System, Global Satellite for Mobile communication, variable message signs, traffic light control system, speed cameras, closed circuit television, satellite, speed radar gun, breath analyser and intelligent transportation road safety measures could be used to mitigate road accidents in Nigeria in line with best global practice.

**Keywords:** Road Traffic Accidents, Causes, Prevention, Mitigation, ICT, Nigeria

# The Role of Vehicular Ad-Hoc Network for Improving Road Safety in Nigeria: Prospect and Challenges

Mustapha Ahmed and Faruku Ambursa

Bayero University,

Kano, Nigeria

[mustybichi9@gmail.com](mailto:mustybichi9@gmail.com) and [fuambursa.it@buk.edu.ng](mailto:fuambursa.it@buk.edu.ng)

**Paper Type:** Empirical research

**Background:** Information and Communication Technology (ICT) has been leveraged in many developed countries to reduce road traffic accident, number of road traffic jam as well as fuel saving (Nekovee, 2005). In particular, Intelligent Transportation System (ITS) also known as VANET (Vehicular Ad Hoc Network), has been developed and used for such purposes. VANET is an emerging wireless application aimed to provide driver assistance and comfort to both driver and passenger, thereby providing reliable and safe transportation system (Nwizege et al., 2018). However, road traffic accident is one of the main causes of loss of life in countries like Nigeria (Atubi, 2009; Afolabi & Kolawole, 2017). According to National Bureau of Statistics (NBS, 2018) more than 2,598 Nigerians died in road traffic accidents between October 2017 and March 2018.

**Purpose:** The aim of this paper is to investigate the prospects and challenges of deploying VANET for improving road safety in Nigeria.

**Method:** Interview and observation methods were employed to find out the deployment of VANET in Nigeria. Road safety personnel, motorist and network administrators were among the people interviewed.

**Findings:** The paper revealed how VANET can reduce road traffic accident, by sharing traffic information among the moving vehicles in Nigeria. It was also observed that the infrastructure was not in place for VANET to be deployed. Moreover, economic constraint was the major hindrance for users to afford VANET technology in Nigeria.

**Keywords:** Road Traffic Accident, Intelligent Transportation System, Vehicular Ad Hoc Network.

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**Stream: ICT and achieving universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all**

## **Assessment of DHIS2 Application to Health Data Demand and Use in Katsina State, Nigeria**

Shamsuddeen Yahaya and Nafisat Sani,  
Katsina State Primary Health Care Development Agency  
Katsina, Nigeria  
[drshamsu01@gmail.com](mailto:drshamsu01@gmail.com),

Jimoh Ibrahim and Bilkisu Nwankwo  
Kaduna State University  
Kaduna, Nigeria  
[drjim20032000@yahoo.com](mailto:drjim20032000@yahoo.com) and [bilikisunwankwo@gmail.com](mailto:bilikisunwankwo@gmail.com)

Adamu Gachi  
Katsina State Ministry of Health  
Katsina, Nigeria  
[gachipharm@gmail.com](mailto:gachipharm@gmail.com)

Abdulahakeem Olorukooba and Lawal Amadu  
Ahmadu Bello University  
Zaria, Nigeria  
[abdulhakimquick@gmail.com](mailto:abdulhakimquick@gmail.com)

**Paper type:** Empirical paper

**Background:** District Health Information System 2 (DHIS2) has revolutionized access to Health Management Information System (HMIS) data not just in the northern states, but across Nigeria, allowing real-time information to influence decision making (Health partners International, 2013). Information garnered from health information systems (HIS) is essential for monitoring health, and for evaluating and improving the delivery of health-care services and programmes. Yet the collection, collation, compilation, analysis and reporting of health data in most developing countries is faced with problems resulting in incomplete, inaccurate and untimely data which is not useful for health decision-making (Karuri et al, 2014). There is growing demand for good quality health information from developing countries as a result of performance-based resource allocation by donors and in Nigeria the HIS is weak and poorly integrated (Makinde et al. 2012, Semeeh et al, 2017). Recognizing the critical role played by a functional HIS, the country initiated an overhaul of the existing system to replace it with the free and open-source web-based DHIS2 (Emmanuel, 2013).

**Purpose:** This study aims to assess the improvement of health data and challenges faced with the application of DHIS2 in Katsina State of Nigeria.

**Methods:** A cross-sectional study was carried out using mixed methods. There are 1630 health facilities across the state reporting through DHIS2. Three hundred and seventy-six were selected through multi-stage sampling technique. A semi-structured self-administered questionnaire was circulated to Record officers and other facility staff responsible for handling

data in the facility including the local government area (LGA) maintenance and evaluation (M&E) officers. Key informant interview (KII) were used to collect information from State HMIS officer, Data Manager and Director Planning & Research. Data was analysed using Microsoft Excel and SPSS version 23. Results were presented with frequency tables and charts. The KII was reported in prose form.

**Results:** Majority of Health facilities (93.2%) submitted monthly summaries promptly to LGA M&E officers and all (100%) of the LGA M& E officers have functional computers for data entry. Two-thirds of M&E officers (60%) had training on DHIS2 and (96.3%) of them wanted more training on DHIS2. The challenges faced by respondents include (87.2%) of data handlers' lack computers at the facility level, so they are still using summary form to send data to LGA M&E officers and so lacked capacity to utilize data. There was also lack of trained staff as well as shortage of staff at the health facilities level. Only 21% of the total facility reporting to the DHIS are visited for quarterly Data quality assessment due to paucity of funds. For the improvement of data demand and use, (72.6%) of health facilities had no issue with out of stock data tools. In KII reported that it is only through DHIS2 that you can have access to data at various levels such as ward and health facility levels at a glance and it is user friendly. The respondents used data to advocate for drugs stock out and also to plan for outreaches based on needs: "malaria test kits have been supplied based on testing rate reported and ACTs supplied based on ACT treatment rate."

**Conclusion:** The state has very high reporting rate on the DHIS platform however this survey has revealed poor data quality because of acute shortage of Human resource for health, lack of regular training and in adequate data quality assessment due to paucity of funds. There is need to institutionalize Quarterly DQA in all reporting facilities, improve on human resource, capacity building and funding to improve data demand and use.

**Keywords:** Health Information Systems; Data Quality; Healthcare Data Demand and Use; DHIS2.

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## Use of Mobile Telephone Calls in Reducing Dropout Rate in Routine Immunization in a Tertiary Health Facility in Kaduna State, Nigeria

Jimoh Ibrahim, Nanben Omole, Grace Nmadu, Farouk Adiri, Nafisat Usman, Clement Woje  
and Musa Kana

Kaduna State University  
Kaduna, Nigeria

[drjim20032000@yahoo.com](mailto:drjim20032000@yahoo.com), [nvable110@yahoo.com](mailto:nvable110@yahoo.com), [jumainmadu@yahoo.com](mailto:jumainmadu@yahoo.com),  
[adirifarouk@gmail.com](mailto:adirifarouk@gmail.com), [nenezego@gmail.com](mailto:nenezego@gmail.com), [cwoje@yahoo.com](mailto:cwoje@yahoo.com) and  
[musakana77@yahoo.com](mailto:musakana77@yahoo.com)

Abdullahi Galadima  
World Health Organisation  
Nigeria  
[galadpharm@yahoo.com](mailto:galadpharm@yahoo.com)

**Paper type:** Empirical research

**Background:** Vaccinating children is one of the most successful and cost-effective public health interventions for addressing childhood mortality and morbidity (Mokaya et al, 2017, Chinawa, 2014). Nevertheless, in Barau Dikko Teaching Hospital Kaduna, Pentavalent 3 vaccine dropout rate has been persistently high (above 10%). The dropout rate above 10% indicates poor utilization of the health facility (Nwokeukwu et al. 2015). This is where electronic health (e-Health) initiatives could help because they have been recognised for their potential to strengthen health systems and to improve access to care (Oliver-Williams et al. 2017). eHealth itself refers to the practice of supporting health care through information and communication technologies (ICT). To address default among clients who already initiated uptake of vaccination services, this operational research will test the use of phone call as reminders to caregivers who had brought their children for their Pentas 1 and 2 vaccines but failed to show up for Penta 3.

**Objectives:** To determine the effect(s) of the use of mobile phone recalls on immunization dropout rates and document barriers to continue utilization of immunization services in the health facility.

**Methods:** This is an interventional study, in which all the children immunized in June 2019 with BCG vaccine to start the immunization regimen, are being followed up until they complete their immunization with Penta 3 vaccine at 14 weeks of age. Prior to this, dropout rates for the three preceding months (March-May) were 10.61%, 10.6% and 10.3% respectively. These were calculated using the immunization register. A comprehensive record of the phone numbers of all the clients who brought their children to receive BCG injections in June 2019 alongside other relevant information would be retrieved from the children's immunization register. Recalls will be made to those who missed their appointed dates for immunization after four weeks. In order to categorise a child as a "dropout", a minimum of 4weeks would have elapsed because this is the interval between the doses for Penta vaccine (Nwokeukwu et al, 2015). Once a client misses an appointment, at least three phone calls will be made to ascertain the reason(s) why and to urge the client to come on the new date agreed upon by the health worker and the client. All new appointment dates will be written and followed up to ensure that the clients actually come to receive vaccinations. The baseline data between March to May was obtained from the immunization register and interval between pre-intervention and post intervention data collection was four months. The clients were followed up till the Penta 3

antigen was received. The variables derived from the child immunization register, the phone conversations and reasons for drop out were entered and analysed using Excel and SPSS version 23. The data were presented in frequency tables and charts, chi-square test was used to determine associations with  $p < 0.05$ .

**Preliminary findings:** Annual Target population of 0-11 months was 914. The total number that registered for the immunization in the months June and July 2019 was 141 of which 102 was recalled for immunization: males 55(53.9%), females 47(46.1%). Therefore the total whose caregivers could be reached for recalls were 102. The mean age of respondents was  $28.4 \pm (SD 5.4)$  years. The dropout between Penta 1 and Penta 3 fell from 10.6%, 10.6%, 10.3% between March to May respectively to 10.2%, 10.1% between October and November respectively. These marginal reductions in dropout rate was because about two-thirds (59.8%) of respondents had already received Penta 3 from nearby health facilities. The other reasons canvassed for not taking Penta 3 include the very far distance of health facility (17.6%) and 8.8% relocated. In this study, caregivers did demonstrate a commitment to immunization by giving distance as the reason why children could not be brought back to BDTH for further vaccines, and they actually continued immunization in centres close their residential area. Majority (90.2%) came to deliver in the hospital and after went back to their residence where they continued the immunization.

**Conclusion:** The findings from this study showed dropout rate reduction but it did not get below 10% which is the target for good utilization of service and reason mostly given was that children had received the vaccine at nearby health facilities. Provision should be made for the issuance of immunization certificates by the community medicine department for the children who complete immunization at the centre to serve as incentives.

**Keywords:** Drop-Out, Mobile Telephone, Calls, Immunization, Penta3 vaccine

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**Stream: ICT and universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes**

**Use of ICT in Improving Sexual and Reproductive Health Care Among Adolescents in Nigeria**

Awawu Nmadu, Istifanus Joshua, Nafisat Usman and Bilkisu Nwankwo  
Kaduna State University  
Kaduna, Nigeria

[drjim20032000@yahoo.com](mailto:drjim20032000@yahoo.com), [nenezego@gmail.com](mailto:nenezego@gmail.com), [bilkisunwankwo@gmail.com](mailto:bilkisunwankwo@gmail.com) and [drjim20032000@yahoo.com](mailto:drjim20032000@yahoo.com)

Chinedu Igboanusi  
2 Division Medical Services Hospital  
Nigerian Army  
Adekunle Fajuyi Cantonment,  
Nigeria  
[chineduofgod@gmail.com](mailto:chineduofgod@gmail.com)

**Paper type:** Secondary research

**Background:** Nigeria is the most populous country in sub-Saharan Africa with more than 60 percent of its population under 25 years of age and 22 percent of the population between the ages of 10-19 years. Reproductive health problems represent a challenge affecting young people in Nigeria. Evidence has shown that majority of young people in Nigeria lack appropriate knowledge on sexual and reproductive health (SRH) and as such are exposed to a host of reproductive health problem such as teen pregnancy, unsafe abortion, HIV/AIDS and other sexually transmitted infections. Sexual and reproductive health issues are not usually discussed with adolescents because of restrictive socio-cultural norms. Modern innovations and technology, including mobile devices and the internet, have been shown to offer enormous potential for increasing access to SRH. To date, there has been limited documentation of the extent to which these methods are utilized by youths in Nigeria.

**Objective:** This review of literature provides an overview of the role that ICT plays in the improvement of reproductive health care among adolescents. It equally explores current evidence around ICT delivered interventions in Nigeria for improving adolescents' access to and utilization of SRH care services.

**Methods:** Peer-reviewed published studies, government and non-government documents, and survey reports between 1990 and 2019 on adolescent sexual and reproductive health ICT interventions in Nigeria were explored using a detailed search strategy. Databases such PubMed, Medline, African Journals Online, Google scholar, World Health Organization (WHO) and UNICEF websites were consulted. The studies involving young people (adolescents and youth) aged 10–24 years to which ICT interventions were delivered for improving their sexual and reproductive health outcomes were included in this review.

**Results:** The evidence suggests that ICT tools are extremely useful for increasing access to SRH care services, both through educating adolescents directly or providing information to health professionals. Information can be provided directly to adolescents or referrals made to clinics or other centres for accessing SRH. Mobile phone-based, web-based and mixed approaches have been successfully employed to improve adolescents' access to SRH services. However, interventions on adolescent use of ICT in improving access to SRH information and services in Nigeria are few.

**Recommendation:** There is a need for the government at all levels to scale up the application of ICT technologies to programmes that promote the SRH of adolescents in the country.

**Keywords:** Adolescents, Information and communication technology, Sexual and Reproductive Health, Nigeria

## **The Role of Information and Communication Technology in Bridging Gaps To Family Planning Services Accessibility In Nigeria**

Farouk Adiri, Clement Woje, Grace Awawu Nmadu, Victoria Nanben Omole, Nafisa Ohunene Usman, Jimoh Ibrahim and Istifanus Joshua

Kaduna State University,  
Kaduna, Nigeria

[adirifarouk@yahoo.com](mailto:adirifarouk@yahoo.com), [cwoje@yahoo.com](mailto:cwoje@yahoo.com), [jumainmadu@yahoo.com](mailto:jumainmadu@yahoo.com),  
[nvable110@yahoo.com](mailto:nvable110@yahoo.com), [just4nene@yahoo.co.uk](mailto:just4nene@yahoo.co.uk), [drjim20032000@yahoo.com](mailto:drjim20032000@yahoo.com) and  
[dristifanus17@gmail.com](mailto:dristifanus17@gmail.com)

**Paper type:** Secondary research

**Background:** Family Planning services and commodities in most developing countries are bedevilled by challenges and barriers especially in hard to reach, remote, stigmatized and displaced population groups. These barriers may be circumvented through the use of Information and Communication Technology (ICT).

**Purpose:** This paper is a narrative review of the role of ICT in bridging the gaps in providing access to essential Family Planning services and commodities in Nigeria.

**Method:** Literature searches of peer-reviewed articles between 2000 and 2019 in databases such as PubMed, Medline, African Journals On line and Google scholar was conducted.

**Findings:** The results showed that ICT has greatly increased access to Family Planning services through educating the public directly or through providing information to healthcare providers. Information could be directed at strengthening referrals to clinics where services could be available using Short Message Service (SMS) hotline. This innovation has been shown to increase the probability to use Family Planning commodities. Web-based platforms have additionally been used to bridge barriers and increase access to Family Planning services and commodities on computer or mobile phones.

**Conclusion:** ICT has an important role to play in accessing family planning information after which clients could be referred to other available services after using online platforms.

**Keywords:** Family Planning, Barriers, Services, Commodities, Information, Accessibility, ICT and Nigeria

## **Securing User's Attribute on the Healthcare Cloud Computing Environment**

**Maria Abur**

Iya Abubakar Institute of Information & Communication Technology  
Ahmadu Bello University  
Zaria, Nigeria  
mmabur1@gmail.com

**Friday Yakubu**

Iya Abubakar Institute of Information & Communication Technology  
Ahmadu Bello University  
Zaria, Nigeria  
yakfriday@gmail.com

**Paper Type:** Empirical research

**Introduction:** Healthcare Cloud Computing (HCC) could be regarded as a set of IT services that are provided to a healthcare provider over a network on a leased basis and with the ability to scale up or down their service requirement. HCC can provide many opportunities and benefits for healthcare systems such as reduce cost, increase flexibility, collaboration, availability and also scalability (Daman *et al.*, 2016; Colin *et al.*, 2016; Maslin *et al.*, 2016; Leila *et al.*, 2018; Daman *et al.*, 2016; Hein, 2019).

Nevertheless, security and privacy are main obstacles to the growth of cloud computing in the health field (Masrom and Rahimli, 2014; Ratnam *et al.*, 2014; Ismaeil *et al.*, 2017). The data stored in cloud virtualized environment can be accessed or managed by many people (Velumadhava *et al.*, 2015). Another concern of shared computing resources within cloud infrastructures is identity and access management. Current identification and authentication methods in healthcare organizations may not be applicable in cloud computing and if these have a combination of unique username/password for certain and sensitive applications, they will present a poor link in the security structure. In the cloud, identity management helps to maintain security, identification and control and focuses on identity and access control (Ismaeil *et al.*, 2017).

There are recent healthcare cloud computing threat management approaches e.g. Hybrid Execution Model (Jaswanthi and NaliniSri, 2013), Vehicular Cloud Computing (VCC) Service-oriented Security Framework (Kang *et al.*, 2015), sHype Hypervisor Security Architecture (Yu *et al.*, 2014), and hybrid RSA Encryption Technique (Sengupta, 2015). The approaches of securing user's attributes are not enough as activities of hackers tend to increase day by day and also opening ways for more security loopholes. Hence, there is advocacy for improvement of these approaches (Esmaeil *et al.*, 2017).

**Purpose:** This paper discusses a novel approach of security and privacy, a modified model of PII Privacy model for Protecting User's attributes on the Healthcare Cloud Environment, introducing AES-128, DCT-M3 and Privacy Token mechanisms into the PII privacy model. Hence, additional security that makes it difficult to exposure the user's PII to security threat is provided (Abur *et al.*, 2018).

**Design/methodology/approach:** The MPPM improves on the existing PII privacy model of Weingartner & Westphall (2014) by introducing an Advanced Encryption Standard one hundred and twenty-eight (AES-128) bits, which is stronger, faster in nature, better in speed and code compactness on a wide range of platforms, low computational overload and better security than the RSA. The problem of user's attributes exposure is overcome by introducing the Discrete Cosine Transform Modulus three (DCT-M3) Steganography techniques. The DCT-M3 Steganography technique is to hide the encrypted user's attributes by AES-128 bits in an image. Similarly, the problem centered on the flow of information during dissemination is overcome by elimination of Where Are You From (WAYF) and introducing the Privacy Token to preserve user's privacy during dissemination and avoiding further reuse of user's attributes and preventing SPs from colluding to profile users. With this approach, users would enter their attributes as plaintext into identity provider (IdP), secured by two IdP privacy mechanisms: Advanced Encryption Standard (AES)-128 cryptography and Discrete Cosine Transform Modulus three (DCT-M3) steganography algorithm. The Advanced Encryption Standard (AES)-128 cryptography converts the User's attributes into *ciphertext* using Discrete Cosine Transform Modulus three (DCT-M3) steganography algorithm which uses modulus 3 as a base factor. The *ciphertext* will then be hidden inside a cover image giving rise to a *stego-image* as it goes through the network to be kept on the IdP.

**Findings:** Each of the security measures used in this work has its own peculiar advantages; therefore, integrating them would provide a stronger security solution than is provided by any of the measures on its own. The DCT-M3 steganographic technique removes any doubt or suspicion to detect the attributes on the ciphertext from the stego-image. Therefore, for a hacker (intruder) to get through, he must first defeat the Steganography technique which is hard before breaking through the AES-128 cryptographic technique to decode the encrypted (user's attributes) or PII which is extremely difficult. The study revealed that using two security techniques is better than using only one security in securing user's information on the healthcare cloud computing environment. This way, the user's privacy and security are preserved.

**Implications/value/originality:** The paper presents a novel approach of security and privacy, adopting the Personal Identifiable Information (PII) privacy model for securing the privacy of the user's attributes on the healthcare cloud computing environment.

**Limitations (if application) and future work:** The research presented a modified model of PII Privacy model for Protecting User's attributes on the Healthcare Cloud Environment, making it difficult to expose the user's PII to security threat. Hence, this MPPM offers a better solution of securing users attributes on transit in the Healthcare cloud environment, thereby ensuring that the privacy of the user is preserved. As future work, the research shall be implemented, and the security of the proposed system measured against the existing system.

**Keywords:** Cloud, Security, Healthcare, Encryption technique, Steganography, PII.

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## ICT and Flood Disaster Preparedness: A Study of Rural and Urban Flood-Prone Communities in Kaduna State, Nigeria

Istifanus Joshua, Muhammad Ibrahim, Aisha A Abubakar, Grace Nmadu, Bilkisu Nwankwo and Clement Woje

[dristifanus17@gmail.com](mailto:dristifanus17@gmail.com), [firstmsibrahim@yahoo.com](mailto:firstmsibrahim@yahoo.com), [draishau@yahoo.com](mailto:draishau@yahoo.com), [jumainmadu@yahoo.com](mailto:jumainmadu@yahoo.com), [bilkisunwankwo@gmail.com](mailto:bilkisunwankwo@gmail.com) and [ewoje@yahoo.com](mailto:ewoje@yahoo.com)

Kaduna State University  
Kaduna State, Nigeria

Chinedu Igboanusi

[chineduofgod@gmail.com](mailto:chineduofgod@gmail.com)

2 Division Medical Services & Hospital,  
Headquarters 2 Division, Nigerian Army,  
Adekunle Fajuyi Cantonment, Ibadan

**Paper type:** Empirical research

**Background:** Flood has become a major hazard in Nigeria in recent years due to a growing population, rapid urbanization and extreme weather events. Disaster preparedness plays a critical role in mitigating the adverse health effects of flood which affects individuals, households, communities and governments. Community disaster preparedness places emphasis on local capacity building and sustainability. Rural communities in developing countries are often the ones that suffer most during flooding. This study assessed the level of flood preparedness in the selected flood-prone urban and rural communities in Kaduna North and Soba LGAs of Kaduna State respectively.

**Method:** A cross sectional study was carried out July and August, 2019 in Ungwan Rimi, Kabala Costain, Kigo new extension in Kaduna North and Garu, Takalafiya Garu and Soba police station communities in Soba LGAs of Kaduna State. Key informant interviews (KIIs) were conducted for the community leaders of the 6 selected communities using KII guide. The collected data were analysed using content analysis.

**Results:** Ungwan Rimi had a better flood preparedness among the communities. The factors influencing preparedness included lack of disaster awareness and education, poverty, absence of Community Emergency Response Team (CERT), and poor early warning system. The effects of flood in the communities included collapsed buildings, loss of crops and household properties and relocation of families.

**Conclusion:** Most of the communities had poor flood preparedness. There is need for effective community flood awareness and education by relevant stakeholders, establishment of CERT and early warning systems in the communities.

**Keywords:** Flood, Flood Preparedness, Rural and urban communities State

**Stream: ICT and research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health**

### **Factors Influencing the Use of Immunization Mobile App among Health Workers at Primary Health Care Facilities in Kano State**

Ahmad Rufai Abubakar, Umar Lawal Bello and Khadijah Nuhu Nasidi  
Bayero University, Kano, Nigeria

[arabubakar.nur@buk.edu.ng](mailto:arabubakar.nur@buk.edu.ng), [umarbe2012@gmail.com](mailto:umarbe2012@gmail.com), [khadja92@gmail.com](mailto:khadja92@gmail.com)

Hayat Imam Humammad Gommaa and Auwal Muhammad Ladan  
Ahmadu Bello University, Zaria, Nigeria

[h\\_gommaa@yahoo.com](mailto:h_gommaa@yahoo.com) and [maladan@abu.edu.ng](mailto:maladan@abu.edu.ng)

Auwal Muhammad and Abdurrahman Suleiman Maru  
Usmanu Danfodiyo University,  
Sokoto, Nigeria

**Paper type:** Empirical research

**Background:** The digital media market has recently experienced an exponential growth of mobile applications (apps), programs designed to perform a specific function on mobile computing devices. Regardless of its amazing level of development and diffusion, not much has been studied about factors affecting the use of immunization mobile app among health workers.

**Purpose:** This study was undertaken to determine the factors influencing the use of immunization mobile app among health workers at primary health care facilities in Kano State.

**Method:** A quasi-experimental design was adopted for this study. The study was conducted at primary health care facilities in Kano State. One hundred and seventy-one participants were selected for the study using multi-stage sampling technique. The health workers were provided with an internet-based immunization mobile app for six months. Later, a structured self-administered questionnaire was used to collect the data from the health workers. Statistical package for social sciences (SPSS) version 23.0 was used to analyse the pre-coded data on an item by item basis. The hypotheses were tested by cross-tabulations using Spearman's rho test of association and the Pearson's chi-square.

**Results:** Findings revealed that significant proportion of the respondents (56.7%) indicated that they were motivated to use mobile application due to its usefulness in updating knowledge on routine immunization. Also, significant proportion of the respondents indicated that they were restricted to use immunization mobile app due to poor electricity supply (52.9%) and too many other work demands (49.7%).

**Conclusion:** Identifying the factors influencing the use of immunization mobile app can provide app developers, marketers, and researchers with important information about the decision process of app use intention. As demonstrated in this study efforts should be made to stabilize power supply and reduce workload among health workers for an efficient use of mobile app for immunization services.

**Keywords:** Factors, Immunization Mobile App, Usage, Health workers, Primary Health Care facilities.

**Stream: ICT and health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries**

**Technology Acceptance Model: An Empirical Study of Electronic Health Record among Health workers in Ahmadu Bello University Teaching Hospital Shika-Zaria, Kaduna State, Nigeria.**

Sekinat Yusuf, Hussaini Suleiman and Mohammed Shehu Kokami  
Ahmadu Bello University, Zaria, Nigeria

[seteab@yahoo.com](mailto:seteab@yahoo.com), [hsuleimanabu@gmail.com](mailto:hsuleimanabu@gmail.com) and [kokami2007@yahoo.com](mailto:kokami2007@yahoo.com)

**Paper type:** Empirical research

**Background:** In Nigeria, patients spend ample time at the clinics waiting to be attended to by healthcare providers and other clerical staff. A lot of reasons have been associated with the causes of the long waiting period at the outpatient department in most clinics in developing countries among which is the issue of manual record keeping. Different pragmatic approaches have been made in order to reduce the waiting period at the clinics among which is the electronic health record (EHR). For EHR to be fully utilized there must be some perceived benefits on the part of the users.

**Purpose:** The study sought to investigate the users' (health workers) acceptance behaviour of HER in Ahmadu Bello University (ABUTH), Shika-Zaria.

**Method:** The study used Davies (1989) technology acceptance model (TAM). Two research questions were raised; the study adopted qualitative methodology. The population of the study included all the health workers in ABUTH using a clustered sampling technique to randomly select the respondents and the process of interviewing was stopped when the data reached the saturation stage. Content analysis of data was used on the data.

**Findings:** It was discovered that if the technology is established, it will assist their management in the planning processes in terms of recruitment of personnel and the use of facilities within certain units in the hospital which would lessen the time patients wait at the clinic.

**Conclusion:** It was concluded that if EHR is adopted at ABUTH, Shika-Zaria, there is the possibility that the technology may be fully utilized because of the inherent perceived ease of use and usefulness as observed by the health workers there by reducing the time patient spend at the public health facility.

**Keywords:** Technology Acceptance, Electronic Health Record, Perceived usefulness, Perceived ease of use, Acceptance behaviour

**Stream: ICT and ending the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases**

**Assessment Status of Awareness of Tuberculosis towards Its Mitigation in Nigeria: Data Analytic Approach**

Ishola D. Muraina, Rafeeah Rufai Madaki and Aisha Umar Suleiman  
Yusuf Maitama Sule University, Nigeria

[ishod2001@gmail.com](mailto:ishod2001@gmail.com), [rafeehmadaki@gmail.com](mailto:rafeehmadaki@gmail.com) and [usayeesh@yahoo.com](mailto:usayeesh@yahoo.com)

**Paper Type:** Empirical research

**Introduction:** The spread of infectious diseases has been seen as a crucial issue that requires drastic attention towards its eradication across the world (Hanaoka et al., 2019; WHO, 2019; Kooffreh et al., 2016). Thus, Tuberculosis as one of the infectious diseases in Nigeria needs urgent measures so as to achieve a healthy society (Kooffreh et al., 2016). Despite the huge fund spent on the eradication of Tuberculosis in Nigeria, its awareness status is yet to be measured to justify the efforts being made (USA Embassy Nigeria, 2012; Misra et al., 2011). Hence, the objective of this study is to assess the awareness status of Nigerians on Tuberculosis.

**Methodology:** The study used quantitative research approach in form of experiment together with data analytic technique to assess the awareness status of Tuberculosis among Nigerians. Besides, the designed instrument used for gathering data was based on Timmermans and Cleeremans (2005) study towards measuring the awareness of Tuberculosis among selected participants (Wierzchon et al., 2012; Ramsøy & Overgaard, 2004)

**Finding:** The result reveals that awareness status of majority of Nigerians is low with respect to tuberculosis in their respective domains.

**Implication of Study:** This study serves as an avenue for the policy makers in healthcare industry (RFI, 2019) to understand the area that requires priority towards eradication or mitigation of tuberculosis in Nigeria.

**Limitation and Future Work:** This study intends to extend its scope beyond analytical technique to visual analytic in future so as to further explore the participants' responses about their awareness on tuberculosis in Nigeria (Oliva et al., 2018).

**Keywords:** Tuberculosis, Infectious Disease, Disease Mitigation, Data Analytic, Assessment Status, Awareness

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## Exploring the Wearable Computing Adoption Factors for the Promotion of Good Health in Africa

Vasileios Yfantis  
University of West Attica  
Greece  
[byfantis@yahoo.com](mailto:byfantis@yahoo.com)

Abel Usoro  
IITEDA  
UK  
[able.usoro@gmail.com](mailto:able.usoro@gmail.com)

**Paper Type:** Conceptual research

**Background:** Good health and well-being are the most important features of the United Nations' sustainable development goal 3. Good health is related to the actions needed for the prevention of health issues by addressing them in a first place and reducing its consequences with the required medical measures. Although this is a common fact, there are African countries with limited access to medical centres or other issues such as bad road infrastructures that prevent people from accessing the medical authorities in time. On the other hand, many African citizens are familiar with the mobile phones and can even use them to register a child's birth through text messages without reaching the local public administration services. If technology is the medium to register a birth, why can it not also be a medium to prevent death? The wearable devices of today have become very cheap and include sensors that can detect the heart rate and the blood pressure. In this case, a patient is able to perform a simple medical self-examination without the presence of a doctor. This is very important because a patient can inform a doctor about his health condition or the doctor may gain access to the patient's historical health condition and take the appropriate medical measures upon the patient's arrival at the health centre.

**Purpose:** Our study focuses on the detection of the factors that may affect the adoption of the wearable technology from the user's side in Africa.

**Method:** The research reviews existing technology acceptance theories before developing a relevant model that would predict adoption of wearable technology (Davis, 1989, Venkatesh et al, 2003). The research borrows perceived usefulness, attitude and behavioural intention from existing models but also adds cost and perceived privacy as variables for the model. The variables are conceived as predictors of behavioural intention to adopt wearable technology for health purposes. The model has been operationalised into a questionnaire that will be pilot tested before administration and analysis.

**Conclusion:** This research is a work-in-progress. Once the data are collected and analysed, relevant conclusions will be reached that will inform decision makers, technology directors and politicians to promote good health in Africa.

**Originality:** A few studies have examined wearable technologies. For example, Grabowski (2015) examined their adoption in Maritime Navigation but this is one of the first studies that investigate wearable technology for health purposes. The few existing studies apparently are

not in Africa. For example, Kim and Chiu's (2019) study was in Korea; and Talukder et al's (2019) study was done in China.

**Keywords:** Wearable technology, well-being, technology acceptance, Africa.

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## Bottom-Up Data Governance Framework for the Advancement of HealthCare Informatics

Shailendra Singh Bisht, Andrew Tajo, Nigel McKelvey and Michael McCann  
[ssbisht1@gmail.com](mailto:ssbisht1@gmail.com), [tajhandrew68@gmail.com](mailto:tajhandrew68@gmail.com), [nigel.McKelvey@lyit.ie](mailto:nigel.McKelvey@lyit.ie) and  
[Michael.McCann@lyit.ie](mailto:Michael.McCann@lyit.ie)

Department of Computing  
Letterkenny Institute of Technology  
Letterkenny  
Co Donegal F92C5XK, Ireland

**Paper type:** Empirical research

**Background:** For most large institutions including healthcare, finding a “single view of the truth” that is, a golden source of organization-wide data, has become a challenging task. Moreover, previous and new data regulation laws such as Health Insurance Portability and Accountability Act (HIPAA), and General Data Protection Regulation (GDPR) have also generated the critical demand to address the data security issue in existing data that is accumulated from several years within the Healthcare legacy systems. The big question is how one can access or purge patient data from all the systems if there is limited tracking or no tracking of data. A framework for data governance may go some way towards addressing this gap in knowledge. Good quality, secured and governed data will work as a catalyst in effective implementation of healthcare informatics and automation.

**Methods:** Research to date reveals that in most of the healthcare institutions and insurance organizations application systems are running in silos and data replication and repetitive transformation leads to severe data quality issues (Health Information and Quality Authority Ireland, 2018). To overcome this problem the incremental approach of data governance stage one is implemented in this research. Application level data stewards were appointed to set up the data dictionary to avoid the data confusion where Person A is stored as ‘Patient’ in GP application system, termed as ‘Subject’ in Pathology record system and known as ‘Client’ while sharing data to Insurance Company. Another dimension of the data governance framework was tested by applying data quality rules at the source system level to achieve maximum consistency and completeness of data.

**Results:** Appointing application level data officers have shown great progress in clarifying the critical data elements that are shared across the systems. Data dictionary is further utilized by data stewards to write the more logical data quality rules for their respective applications. The new data quality rule framework is helping to bring consistency of critical data across the applications. The data quality dashboard and reports are also consumed by operational users to fix real-time data issues immediately.

**Conclusion:** This research synchronised people, process and technology. In addition, it proposes the new bottom-up approach of Data governance model that comprises of three components: a regional level Data governance accountability role, Data Quality check-post and incremental implementation of data governance to improve data quality and the end to end data traceability of data.

**Keywords:** data governance, healthcare, informatics, bottom-up.

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# Development of Semantic-based Algorithmic Selection and Control Methods: A Social Process Domain Analysis

Kingsley Okoye<sup>a,b</sup>

<sup>a</sup>Writing Lab, TecLabs, Tecnologico de Monterrey, Nuevo León, Mexico.

<sup>b</sup>School of Architecture Computing and Engineering, College of Arts Technologies and Innovation,

University of East London, Docklands Campus, United Kingdom. E16 2RD.

[kingley.okoye@tec.mx](mailto:kingley.okoye@tec.mx)

**Paper Type:** Empirical research

**Motivation:** Information technology is changing the way digital devices and social platforms are being constructed. Moreover, most of existing methods for analysing the unprecedented large amounts of information (datasets) captured about the social domains (e.g. places, individuals, things, mobilities, migration and spatial change, etc) focus on building methods or algorithms to process (information) for analysts to understand its different perspectives. Perhaps, the major challenge has not only been on how to develop systems that are capable of providing intelligent methods for exploring the extracted pieces of information or datasets to make them explicable in reality (Calvanese et al, 2016; Okoye et al, 2019), but there is also an ever-increasing need for management/enhancement of the social processes in question (Kossinets & Watts, 2009; Masso, 2011) e.g. through the online recommendation systems (Stan et al, 2014), understanding of the social homophily or ethnic differences (Masso, 2010), quality of the extracted information and values (Okoye et al, 2016; 2017).

**Research questions:** Primarily, this paper focuses on addressing the following questions:

- 1) How best can algorithms/methods be developed to support the discovery of useful patterns (e.g. socio-spatial or homophily similarities and differences) from the social domains?
- 2) How can process automation techniques (algorithmic control) be used to analyse, monitor and improve the socio-spatial dimensions or behaviours?
- 3) How can the new technologies such as semantic modelling and reasoning be used to improve the process of (re)construction/analysis of the social homophily (e.g. through sentiment analysis) from the syntactic level to a more conceptual level?

**Purpose:** The goal of this paper is to “extract streams of data from a social process domain and describe formats that allow for improved analysis of the captured datasets”. In other words, this paper demonstrates that results of the (big) data analysis and models can be improved by capturing the semantic viewpoints (deMedeiros et al, 2008; Okoye et al, 2018). Thus, the method of this paper is based on two types of probes (i) how to make use of the semantics that describes the available data? and (ii) how to mine the semantic information from the resultant models?

**Design/Methodology/Approach:** The method of this paper is introduced as a fusion theory devoted to representing (analysing) information extracted from the process domains (e.g. the social domain) in a qualitative and yet quantitative manner. This is done through the integration of three main building blocks; semantic annotation (labelling), representation (ontology) and reasoning (reasoner).

**Implications:** The following are the implications of the research:

- extraction and semantical preparation of data to show how we synchronize events data formats for mining at a more abstraction level.
- transformation of the datasets or models into minable executable formats to support the discovery of valuable information through the semantic-based approach.

**Limitations and directions for future work:** the method for semantic-based analysis (i.e. annotated logs or models, ontologies, and reasoner) that underlies the method of this paper assumes that the work has proposed a process analysis technique which can possibly be introduced or re-extended in a different, or yet, more resourceful way. This is owing to the fact that semantic-based process analysis as described in this paper is a new area within the Process Mining (PM) field and there are not too many tools or algorithms that support such an approach currently in the literature. Therefore, we assume that this work is only an incentive for more robust and intensive research to come within the context of this paper.

**Keywords:** semantic technologies, algorithm development, process modelling, events data, social domains, information systems.

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**Digital communication: A tool for sustainable development of Librarians in tertiary institution in CRS of Nigeria**

**Undie, Felicia Nkatv**

Department of Library and Information Science  
Cross River University of Technology  
Calabar

Cross River State, Nigeria

[nkatvfelicia@gmail.com](mailto:nkatvfelicia@gmail.com)

**Ogunjimi, Blessing Etukudo**

Department of Library and Information Science  
University of Calabar, Calabar

Cross River State, Nigeria

[blessrobert@yahoo.com](mailto:blessrobert@yahoo.com)

**Paper type:** Empirical research

**Purpose:** The main purpose of this research work was to investigate whether digital communication tool relates with sustainable development of librarians in Tertiary institution in Cross River State of Nigeria. This work recognizes how diverse communication tools have affected our daily life as well as research and development activities. The advent of computer advances and communication technologies have opened up new ways of collecting, organizing, analysing, presenting and disseminating scientific and technical information. Library and information professionals in tertiary institutions need to update their knowledge and skills in information and communication technology (ICT) as they play effective roles in enabling the library to perform its role as an information system for the society. This study sought to find out: i. whether the use of email relates with sustainable development of librarian in Cross River State. ii. Whether the use of newsgroup relates with sustainable development of librarians in Cross River States iii. Whether the use of online forum relates with sustainable development of professional librarians in Cross River State. To achieve these purposes, three hypotheses were formulated for the study as follows: Hypothesis 1: There is no significant relationship between the use of Email and sustainable development of librarian in Cross River State Hypothesis 2: the use of Newsgroup does not significantly relate with sustainable development of librarian in Cross River State. Hypothesis 3: There is no significant relationship between the use of Online forum and sustainable development of professional librarians in Cross River State

**Design/Methodology/Approach:** The study made use of librarians in tertiary institutions in Cross River State of Nigeria. Specifically, both Para-professional and professional librarians from University of Calabar, Cross River University of Technology, College of Education Akamkpa, Federal College of Education, Obudu, College of Health Technology, Calabar and School of Nursing Itigidi were involved in the study. Survey research design was used for the study. A sample of three hundred and forty-one (341) para-professionals and professional librarians was selected for the study. The selection was done through the purposive sampling technique. A well - structured and validated instrument titled Digital Communication tool and sustainable Development of Librarian questionnaire (DCTSDLQ) was used to collate data for

the study. The instrument was estimated for its reliability using Cronbach Alpha reliability method. The reliability indices ranges from 0.75 – 0.89 and this indicated that the research instrument was highly reliable. Pearson Product Moment Correlation Analysis was adopted to test the hypotheses of the study. All the hypotheses were tested at.05 level of significance.

**Findings:** The study revealed among others that the use of email has a significant positive relationship with sustainable development of librarian, and that the use of newsgroup has a significant positive relationship with the sustainable development of librarians. The study equally revealed that the use of online forum has a significant relationship with sustainable development of professional librarians in Cross River State.

**Originality/value:** Based on the findings of the study it was recommended among others that tertiary institutions in Cross River State should provide basic skills, arrays of digital communication tools and ICT infrastructures to enhance the lots of librarians' and other professionals to access information desired for learning and the sustainability of paraprofessionals and professional development of Librarians.

# The Use of Virtual Learning Environment for a Sustainable Distance Education in Nigeria: Challenges and Prospects

Fatima Shehu Kabir  
Kaduna State University Kaduna, Nigeria  
[kfatimashehu@kasu.edu.ng](mailto:kfatimashehu@kasu.edu.ng)

**Paper Type:** Theoretical review paper

**Background:** Advancement in information and communications technology has impacted on teaching and learning tremendously such that the traditional emphasis on print in the educational system is gradually giving way to technology-enhanced learning (TEL). In today's digital age, educational paradigms are embracing more flexible approaches such as online or virtual learning, blended learning and collaborative models of learning. In order to have a sustainable distance education system in Nigeria, the use of such technologies has become pertinent. A virtual learning environment (VLE) provides academic institutions efficient and effective means not only for supplementing traditional classroom teaching, but also support distance education. Technology-enhanced distance education promises to solve the problem of access to quality education in Nigeria, where every year, over two million students apply for admission into various universities in the country, but less than 20% of them get admitted into the universities (Anene, 2014; Ofulue, 2011). Indeed, as far back as 1948, the right to education for all was enshrined in the Universal Declaration of Human Rights (United Nations, 2019), hence globally, countries are making a concerted effort to ensure that their citizens have access to quality education (Kabir, 2016). This is in line with the notion of "Sustainable Development Goals (SDGs)", which places emphasis on a global commitment to providing quality basic education for all, using new digital technologies such as the VLE.

**Purpose:** This paper discusses the implementation of VLE in five selected and accredited Distance Learning Institutions in Nigeria. They are: National Open University of Nigeria; Obafemi Awolowo University Ife, Distance Learning Centre; Centre for Distance and E-Learning, University of Nigeria Nsukka; Ahmadu Bello University, Zaria; and University of Ibadan Distance Learning Centre.

**Methods:** Literature searches were made of peer-reviewed articles between 2000 and 2019. Use of peer-reviewed journal articles, Electronic Databases: UNESCO, United Nations, and Google Scholar was made.

**Findings:** A major setback in the implementation of Open Distance Education in Nigeria is lack of a revised ICT policy suitable for Technology-enhanced Distance Learning in Nigeria. In addition, there is paucity of an appropriate Regulatory Agency for Open and Distance Education.

**Conclusion and Recommendation:** ICT policy should be revised and provision should be made of adequate funding as well as training and retraining of faculty members on the use of VLEs. Key recommendation centre on a balanced use of VLEs to achieve global best practice in line with United Nations Sustainable Development Goals for Distance Education delivery in Nigeria. The implication of this study for university faculty and administrators emphasises that Sustainable Development goals related to education and well-being cannot be achieved unless serious attention is paid to access and massification of technology-enhanced distance education.

**Keywords:** E-Learning, Online Learning, Open and Distance Education, Learning Management System, Virtual Learning Environment, Sustainable Development.

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# **The Role of Library in the Rehabilitation of Inmates: A Case Study of Lokoja Minimum Prisons, Kogi State**

Mohammed Adamu  
University of Kwa Zulu-Natal, South Africa  
[mohammed.adamu1940@gmail.com](mailto:mohammed.adamu1940@gmail.com)

Abel Usoro  
IITEDA, UK  
[able.usoro@gmail.com](mailto:able.usoro@gmail.com)

Mayomi Shola Dickson  
Kogi State Polytechnic, Nigeria  
[dicksonmayomi@gmail.com](mailto:dicksonmayomi@gmail.com)

**Background:** A major goal of prisons is to rehabilitate inmates to as to reintegrate them into society (Larsen et al, 2019). Libraries can play a major role in achieving this goal because it can act as an information provider and an educational resource from which inmates can prepare for future jobs and functions in the society. They possess the capability to contribute to the meaningful development of their economy, particularly if their skills and talents are properly harnessed through reformation programmes (Chiemezie, 2005).

**Purpose/Objective:** This study evaluates the extent to which Lokoja Old and New Prisons fulfil the above goal.

**Method:** The study was carried out on these two prison establishments in Lokoja, Kogi state. Instruments for data collection was questionnaire and a semi-structure interview. Data was analysed using descriptive statistic and result presented in tables. Simple random sampling technique was used. A total of 50 randomly selected inmates from the two prisons formed the population of study. The role of library as an information provider, and educational resource in the rehabilitation of inmates were analysed.

**Findings:** Findings from the study revealed that there is a functional library in New Prison with relevant books and inmates make maximum use of it. However, the library capacity cannot accommodate all its users at a time. The library is being managed by para-professional librarians. Besides, the variety of publications is very limited. In the old prison, inmates lamented about non-existence of library.

**Recommendation:** The study recommends that: the prison library is set up at the old prison and should make use of current information technology which will not hinder the prison security. The government of Kogi Sate should enrich the library at New Prison with textbooks in various skill acquisition skills programmes to equip the inmates more in their chosen careers. Both libraries should be supervised/managed by professional librarians. Prison library collection should include materials in print and other formats and in native language to meet the informational, educational, cultural, recreational and rehabilitative needs of the prison population.

**Keywords:** Inmates, rehabilitation, prison, library and librarians

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