

## Competencies and Barriers to the Use of Nursing Informatics among Nurses in Primary, Sec-ondary and Tertiary Healthcare Facilities in Nigeria

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**Background and Purpose:** Nurses have always been at the forefront of patient's care and are expected to provide safe and quality care that is moderated by technology to consumers of health care. To meet these expectations, nursing informatics competencies are critical and essential for nursing practice. This study explored nurses' knowledge, perception of their competencies and the barriers to the use of nursing informatics at the three levels of care in a State in Nigeria. This was done with the purpose of collecting baseline data to inform intervention for knowledge update and enhanced use of nursing informatics in practice.

**Methods:** Adopting a cross sectional survey design, data was collected from 350 nurses from 1 tertiary, 6 secondary and 30 primary health care facilities using multistage sampling technique from 6 towns that have at least two out of the three categories of health care facilities in the State,. Proportionate samples were drawn based on the population of nurses in the 3 categories of health facilities with 175 from tertiary, 115 from secondary, and 60 from primary health care facilities.

**Results:** The result showed a fair knowledge of nursing informatics by 55.4% of the respondents. In each of the three levels of competency, respondents perceived themselves as 'competent' and 'not competent' based on their self assessment. 'Limited access to computer' was the most perceived barrier by 55% of respondents to the utilization of nursing informatics.

**Conclusions:** The study concluded that the competency of nurses in nursing informatics is poor due to various perceived barriers.

**Keywords:** Competencies Informatics Barriers Nurses Nigeria

### 1 Introduction

Nurses have always been at the forefront of patient's care and are expected to provide safe and quality care to consumers of health care, as an integral aspect of nursing practice in a technical and digital environment [1]. To meet these expectations of providing safe and effective patient care in the healthcare environment, nursing informatics competencies are critical and essential for nursing practice [2].

Studies have shown that nurses are key stake holders in developing, implementing and evaluating informatics solutions for many years. They have taken up various roles beyond care giving: they integrate the services of virtually every other discipline in the health care system, they organize, plan and support the care of patient populations and communities, they are also committed to ensuring that the care given to patient comes together in timely and appropriate ways [1,3,4]

Health care is an information intensive industry, in which quality and timely information is a critical resource [5]. Information is the key to effective decision making and integral to quality nursing practice. Much of what nurses do involves information, which starts from assessing health care needs of patients, to developing nursing care plan, to implementing the actions, to evaluating the outcomes and to communicating patient's information to other health care professionals [6]. Beyond information management in day-to-day practice, in the 21st century, information is doubling every five years, if not tripling in

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quantity and quality. It is therefore crucial that nurses have access to the latest scientific information to support the delivery of high quality care and the development of nursing knowledge and theory [4]. These have given rise to the emergence and increasing prominence in the field of nursing informatics.

Nursing informatics is a product of combination of computer, information and nursing sciences. It has emerged to assist in the management and processing of nursing data, information, and knowledge to support nursing practice, education, research, and administration. Information intensive disciplines like nursing require careful investigation into the application of computers to process nursing information [7].

As the use of information technology further developed in nursing, conceptually oriented definitions emerged, such as the widely applied definition by Graves and Corcoran [8] who proposed that nursing informatics is a combination of computer science, information science, and nursing science designed to assist in the management and processing of nursing data, information, and knowledge, to support the practice of nursing and the delivery of nursing care. This definition and emphasis on nursing data, information and knowledge was a new change in direction in the late 1980s and others immediately adopted the definition.

As soon as nursing informatics gained recognition as a nursing specialty, the Council of Computer Applications in Nursing of the American Nurses Association (ANA) [9] provided a new definition for the field. The ANA expanded the previous definitions by incorporating the role of the informatics nurse specialist into the definition of nursing informatics as a specialty that integrates nursing science, computer science, and information science in identifying, collecting, processing, and managing data and information to support nursing practice, administration, education, and research and to expand nursing knowledge. The purpose of nursing informatics is to analyze information requirements, design, implement and evaluate information systems and data structures that support nursing, identify and apply computer technologies for nursing.

This definition has however been further refined over the years in line with progressive efforts aimed towards an accurate description of the scope and standards of the practice of nursing informatics. The latest of this was by American Nurses Association which states that;

Nursing informatics is a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, knowledge, and wisdom in nursing practice. Nursing informatics facilitates the integration of data, information, knowledge, and wisdom to support patients, nurses, and other providers in their decision-making in all roles and settings. This support is accomplished through the use of information structures, information processes, and information technology. [10, p.65]

Nurses have received noteworthy opportunities to be aware of current information when making decisions as a result of improvement in information technology over the years. This has accelerated efforts to implement information system such as the electronic health record, which has the potential to enhance nurses' decision-making regarding the delivery of care by supplying access to health information about clients, allowing data entry, and offering electronic access to scientific knowledge, also it has created new roles for nurses. This raises a greater need for all nurses to integrate nursing informatics competencies into their practices [6].

Over the years, various groups of theorists and educators have proposed essential competencies and literacy skills for nurses in practice, research, education and administration [7]. Despite the fact that nursing informatics is a highly specialized field, there are foundational informatics competencies that all graduating nursing students and practicing nurses should possess to meet the standards of providing safe, quality, and competent care [1]. The need to adopt a culture in nursing that promotes acceptance and use of information technology has been identified as an imperative initiative to establishing nursing informatics competencies and educational strategies [7].

Various emerging taxonomies for describing nursing informatics competencies have been discussed in the literature. The TIGER Nursing Informatics Competencies Model [1] consists majorly of three parts: Basic computer competencies, information literacy and information management. Kaminski [7] also identified three levels of competencies as: beginner, entry or user level, intermediate or modifier level and advanced or innovator level of competency. Each of the three competency levels explained by TIGER [1] and Kaminski [7] include both knowledge and skills required to: use information and communication technologies to input, recover and maneuver data; interpret and organize data into information to affect

nursing practice; and combine information to contribute to knowledge development in all areas of nursing.

A "User" level of competency as described by Kaminski [7] indicates nurses who demonstrate core nursing informatics competencies. This is the basic level that all nurses should minimally demonstrate, no matter what area of practice he or she works in. A "Modifier" level of competency includes nurses who have mastered basic skills and use technology in inventive ways in their practices. The "Innovator" level of competency indicates practicing nurses, nursing administration, nurse researchers and educators who demonstrate advanced and specialized nursing informatics competencies, and have mastered expert skills and use technology in design, plan and coordinate the use of technologies and informatics theory in nursing.

All proposed frameworks include competencies that describe:

- the use of information and communication technology (technical competencies),
- the use of automated information in a professional context (utility competencies),
- decision-making with respect to planning for and using both the technology and information (leadership competencies) [7].

A good number of theorists have emphasized the need for every nurse whether employed in the practice or education setting, to develop a minimum of a "user" level in computer literacy and informatics theory [7]. Herbert (as cited in [7]) outlined some strategies for achieving nursing informatics competencies in the workplace, which include in-service training, intranet ready modules, access to online resources, opportunities for continuing education, availability of and access to resources needed for utilization of nursing informatics.

Herbert, further pointed out some barriers to achieving nursing informatics competencies in nursing practice, and this includes restricted access to training and training systems for nurses and nursing students, few leaders and educators with nursing informatics skills, and limited empirical support for the contributions that Information Communication and Technology (ICT) can or will practically make to nursing and patient outcomes.

While nursing informatics competencies hold a very significant place in the provision of safe and quality care to patients and consumers of healthcare, there is a dearth of information on the competencies of nurses in utilization of nursing informatics in providing nursing care in Nigeria, hence this study attempt to assess the perceived competency level of nurses' in nursing informatics in Osun State, Nigeria.

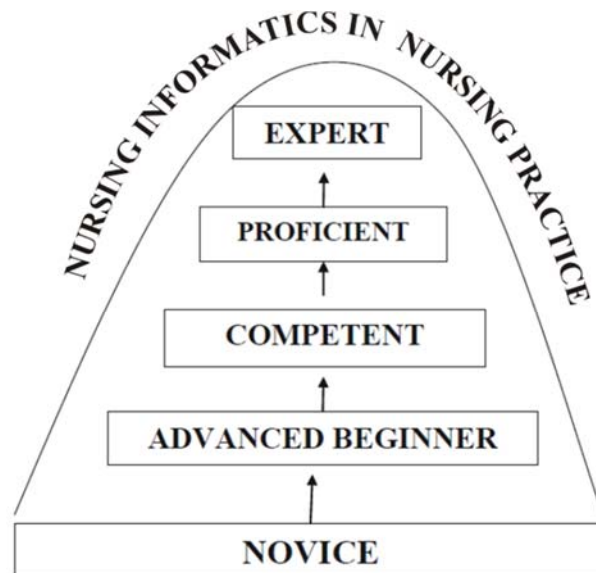
### **Theoretical Framework - From Novice to Expert Theory**

The Novice to Expert theory as the underpinning construct theory used in this study was first proposed by Dreyfus and Dreyfus [11] as the Dreyfus Model of Skill Acquisition, and later applied and modified to nursing by Benner [12], it is a very useful and important theory that clearly applies to nursing informatics.

The currently accepted five levels of development within the Novice to Expert theoretical model as presented by Benner start from the bottom rung at the Novice level and move upward through Advanced Beginner, Competent, Proficient, and Expert levels. Each level builds on the level before it as the learner advances from a beginner level then gains knowledge, skills, perceptions, intuition, wisdom and most important of all, experience in their given field of practice [13]. Every one of these five levels of skill acquisition has unique and different characteristics

**NOVICE:** With regards to nursing informatics, a novice nurse does not know anything about ICT and its application in nursing practice. He/she has to memorize the features and works within stated rules in the application of ICT. To improve, the novice nurse needs monitoring, either by self-observation or instructional feedback. For example, a nurse learning to use a new hospital information system needs explicit instruction and rules to learn to use the computer and manipulate the software, this most often is achieved by training in form of continuing education or workshop.

**ADVANCED BEGINNER:** An advanced beginner nurse in nursing informatics is still dependent on rules, but as he/she gains more experience with real life situations in terms of data gathering and processing for client/patient, he/she begins to notice additional aspects that can be applied to related conditions.



**Fig. 1** Novice to Expert theory

**COMPETENT:** At this stage, the competent nurse grasps all the relevant rules and facts of the field of nursing informatics and is, for the first time, able to bring his/her own judgment to each case. This is the stage of learning that is often characterized by the term “problem solving”. For example, a competent level nurse in nursing informatics would be able to use a hospital information system with ease, and know how to solve technical difficulties or interpret conflicting data. He/she is able to comfortably manage and extract information from software for storing client’s/patient’s electronic records.

**PROFICIENT:** This stage is referred to as fluency and is characterized by the progress of the nurse from the step-by-step analysis and solving of the situation to the holistic perception of the entire situation. The proficient nurse in nursing informatics would know how to interpret data from various departmental records and provide appropriate guidance to other members on the team as needed.

**EXPERT:** A nursing informatics expert has a vast range of experienced situations to the extent that each specific situation immediately dictates an intuitively appropriate action. After a great deal of experience actually using a system in everyday situations, the expert nurse discovers that without using any rules, situations simply elicit from his/her appropriate responses. The proficient nurse, immersed in the world of skillful activity, sees what needs to be done, and decides how to do it. The expert nurse does not only know what needs to be achieved, he/she knows how to achieve his/her goal.

This ‘expert’ level is the peak of the theory but it does not signify that development stops, the expert nurse needs to keep abreast of information, update and evaluate his/her skills in order to maintain the expertise.

## 2 Materials and Methods

### *SAMPLE AND SAMPLING.*

This study employed a cross sectional survey design using multistage sampling technique. It was conducted in government owned primary, secondary and tertiary health care facilities in Osun State, Nigeria. All the registered two thousand and eighteen (2018) nurses working in the three tier health care facilities

in the state formed the target population. Six major towns (Osogbo, Ile-Ife, Ikirun, Ede, Iwo and Ilesa) that have at least two out of the three categories of health care facilities used were purposively selected, from where the samples for tertiary, secondary and primary health care facilities were drawn. The sample for this study was determined using Yamane's formula [14]  $n = N / (1 + N(e)^2)$  where  $n$  is the sample size,  $N$  is the population size and  $e$  is the level of precision, which is usually set at 0.05. A sample size of 339 was obtained using this formula, which was rounded up to 350, given room for 5% attrition rate. Out of the six major towns that met the inclusion criteria, thirty seven health care facilities (1 tertiary, 6 secondary and 30 primary) were systematically selected. Samples from the three health care facilities categories were then proportionately drawn; 175, 115 and 60 nurses were randomly selected from tertiary, secondary and primary health care facilities respectively. The lists of all the nurses working in the facilities were collected as the sampling frame, from which the samples were drawn.

#### ***INSTRUMENT.***

The questionnaire was structured and self-developed from a review of literature on previous work on nursing informatics [5,7]. It has four parts; the first part contained nine questions and assessed the subjects' demographics, while the second part contained twelve questions which assessed the respondents' knowledge on nursing informatics. The third part contained thirty-one questions of 4-point Likert scale of Novice (N), Beginner (B), Competent (C), and Proficient (P) which were used to assess the perceived level of respondents' competency in the utilization of nursing informatics. The last section measured the perceived barriers of respondents using thirteen questions of 5-point Likert scale of Strongly Agree (SA), Agree (A), Uncertain (U), Disagree (D), Strongly Disagree (SD).

#### ***PILOT STUDY.***

The pilot study was conducted for two weeks in Ado - Ekiti, Ekiti State using 20 nurses. The reliability testing of the research instruments was done using split half reliability method. The responses to the test items were separated into odd and even numbers rated and correlated using spearman rho correlation coefficient. A correlation coefficient value of 0.9 was got affirming the reliability of the instrument and ensuring that the questions could be understood and answered by all.

#### ***DATA COLLECTION PROCESS.***

Data was collected within a period of three months, which allowed the researcher to move round the facilities in the six towns selected. An ethical clearance to conduct the study was obtained from the Institutional Review Board of Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) Ile-Ife, and permission was obtained from the Director of Nursing Services in each of the health care facilities used. Informed consent to participate in the study was also sought from individual nurses' and their right to privacy was respected. Some questionnaire were collected on site, however copies were left with the head of the units or facilities as the case may be, for those who are too busy to answer the questionnaire immediately, and for those who were on shift duty, which were collected during the return visits.

#### ***DATA ANALYSIS.***

Data were gathered, sorted and entered into the Statistical Package for Social Sciences (SPSS) version 17. Descriptive and inferential statistics were carried out. Responses to test items on the knowledge scale were rated as 1 for each correct answer, and 0 for a wrong answer giving a total obtainable score of 12 (100%). Therefore, knowledge scores between 70-100% were rated very good, 60-69% as good, 50-59% as fair, and 0-49% as poor.

The Likert scale questions on competencies were scored as Novice (1), Beginner (2), Competent (3), and Proficient (4). Scores were later categorized as Competent (93-124), and Not competent (31-92). Perceived barriers were also scored as Strongly Agree (5), Agree (4), Uncertain (3), Disagree (2), Strongly Disagree (1), and then categorized as Agree (52-65) and Disagree (13-51).

### 3 Results

#### 3.1 Socio-demographic data

The respondents' age range was between twenty (20) and fifty nine (59) years. Majority of the respondents were females; 81.1% in tertiary health facilities, 73% in secondary health facilities while 78.3% in the primary health care facilities. Majority of the respondents were married; 68.6% in tertiary health facilities, 82.6% in secondary health facilities and 71.7% in the primary health facilities. Other correspondents' characteristics were shown in Table 1.

**Table 1.** Respondents' Socio-demographic data

Socio Demographic Characteristics	Tertiary Health facility Frequency n (%) N=175	Secondary Health facility Frequency n (%) N=115	Primary Health facility Frequency n (%) N=60
<b>Age Range (Years)</b>	Mean age= 35.8	Mean age= 39.9	Mean age= 38.2
20-39	SD= ±9.3	SD= ±12.5	SD= ±10.1
40-59	120 (68.6)	55 (47.8)	34 (56.7)
	55 (31.4)	60 (52.2)	26 (43.3)
<b>Sex</b>			
Male	33 (18.9)	31 (27.0)	13 (21.7)
Female	142 (81.1)	84 (73.0)	47 (78.3)
<b>Religion</b>			
Christianity	143 (81.7)	78 (67.8)	42 (70.0)
Islam	32 (18.3)	37 (32.2)	18 (30.0)
<b>Marital status</b>			
Single	55 (31.4)	18 (15.7)	15 (25.0)
Married	120 (68.6)	95 (82.6)	43 (71.7)
Widowed	0 (0.0)	2 (1.7)	2 (3.3)
<b>**Professional Status</b>			
NO II	73 (41.7)	25 (21.7)	21(35.0)
NO I	37 (21.1)	28 (24.3)	10(16.7)
SNO	19 (10.9)	9 (7.8)	7(11.7)
PNO	12 (6.9)	11 (9.6)	6(10.0)
CNO	18 (10.3)	39 (33.9)	14(23.3)
ADNS	16 (9.1)	3 (2.6)	2(3.3)
<b>**Professional/Educational Qualification</b>			
RN	38 (21.7)	24 (20.9)	20 (33.3)
RM	6 (3.4)	5 (4.3)	2 (3.3)
RN/RM	76 (43.4)	52 (45.2)	26 (43.3)
RPHN	5 (2.9)	4 (3.5)	6 (10.0)
B.Sc/BNSc	43 (24.6)	25 (21.7)	6 (10.0)
M.Sc	6 (3.4)	3 (2.6)	0 (0.0)
Others	1 (0.6)	2 (1.7)	0 (0.0)
<b>Years in Practice</b>			
0-5 years	72 (41.1)	33 (28.7)	21 (35.0)
6-10 years	41 (23.4)	22 (19.1)	14 (23.3)
11-15 years	25 (14.3)	2 (1.7)	6 (10.0)
16-20 years	12 (6.9)	13 (11.3)	6 (10.0)
Above 20 years	25 (14.3)	45 (39.1)	13 (21.7)

\*\*NO- Nursing officer, SNO- Senior Nursing Officer, PNO- Principal Nursing Officer, CNO- Chief Nursing Officer, ADNS-Assistant Director of Nursing Services, RN- Registered Nurse, RM- Registered Midwife, RPHN- Registered Public Health Nurse, BNSc- Bachelor of Nursing Science Degree, MSc- Master of Science Degree.

### 3.2 Knowledge of Nursing Informatics

Majority of the respondents had fair knowledge of nursing informatics across the levels of health facilities; 53.7%, 65.2%, 41.7%, in tertiary, secondary and primary health facilities respectively, with an overall mean of 5.92  $\pm$  2.2 (table 2)

**Table 2.** Summary of Distribution of Respondents' performance on the Knowledge of Nursing Informatics

LEVEL OF KNOWLEDGE	Health Facilities			Total
	TERTIARY	SECONDARY	PRIMARY	
	N=175 Mean=5.99 SD= $\pm$ 2.2	N=115 Mean= 5.78 SD= $\pm$ 2.1	N=60 Mean=6.00 SD= $\pm$ 2.5	N=350 Mean= 5.92 SD= $\pm$ 2.2
Very good (70-100%)	16 (9.1)	12 (10.4)	8 (13.3)	36 (10.3)
Good (60-69%)	53 (30.3)	24 (20.9)	22 (36.7)	99 (28.3)
Fair (50-59%)	94 (53.7)	75 (65.2)	25 (41.7)	194 (55.4)
Poor (0-49%)	12 (6.9)	4 (3.5)	5 (8.3)	21(6.0)
Total	175 (100)	115 (100)	60 (100)	350 (100)

### 3.3 Perceived Competency

The respondents' perceived level of competency was measured across the three health care facilities using the three broad levels of User, modifier and innovator. In each of the three levels of competency, respondents perceived themselves as 'competent' and 'not competent' based on their self-assessment. As shown in Table 3, more than half of the respondents (64.3%, 61.9% and 68%) in user, modifier and innovator levels of competency perceived themselves as 'not competent' (novice+beginner) across primary, secondary and tertiary health care facilities.

**Table 3.** Categories of Respondents' Perceived Level of Competency

Competency Level	Health Care Facilities			Total (%) N=350
	Frequency (%) N=175 TERTIARY	Frequency (%) N=115 SECONDARY	Frequency (%) N=60 PRIMARY	
User level				
<b>Not-competent</b>				
Novice	13 (7.4)	26 (22.6)	12 (20.0)	23 (14.6)
Beginner	93(53.1)	63(46.1)	28 (46.7)	174(49.7)
<b>Competent</b>				
Competent users	57 (32.6)	29(25.2)	18(30.0)	104(29.7)
Proficient users	12(6.9)	7(6.1)	2(3.3)	21(6.0)
<b>Total</b>	175(100)	115(100)	60(100)	350(100)
Modifier level				
<b>Not-competent</b>				
Novice	22(12.6)	28(24.4)	10 (16.7)	60 (17.1)
Beginner	77(44.0)	47(40.9)	33 (54.9)	157(44.8)

<b>Competent</b>				
Competent users	66 (37.7)	35(30.4)	16(26.7)	117(33.4)
Proficient users	10(5.7)	5(4.3)	1(1.7)	16(4.5)
<b>Total</b>	175(100)	115(100)	60(100)	350(100)
Innovator level				
<b>Not-competent</b>				
Novice	21(12.0)	35(30.4)	12 (20.0)	68 (19.4)
Beginner	85(48.6)	49(42.6)	36 (59.9)	170(48.6)
<b>Competent</b>				
Competent users	60(30.4)	29(25.3)	11(18.4)	100(28.6)
Proficient users	9(5.1)	2(1.7)	1(1.7)	12(3.4)
<b>Total</b>	175(100)	115(100)	60(100)	350(100)

### 3.4 Barriers to Nursing Informatics Competency

There were thirteen barriers perceived by the respondents that have contributed to their poor competency in utilization of nursing informatics in practice. Limited access to computer was the most perceived barrier to the utilization of nursing informatics by 55% of respondents while the thought of being too old to start learning computer was the least perceived barrier by 14.6% of respondents. Other perceived barriers were shown in fig. 2.

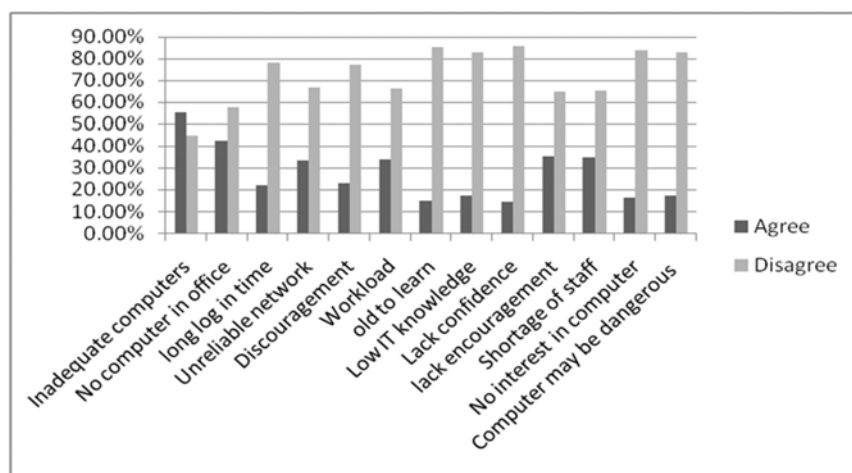


Fig. 2. Respondents' Perceived Barriers

### 3.5 Relationship between Nurses' Years of Experience and Levels of Competence

Correlation co-efficient was used to test the null hypothesis which states that there is no significant relationship between nurses' years of experience and their levels of competency in utilization of nursing informatics. The p values were less than 0.05 across the three levels of competencies (p=0.001) for user competency level, (p=0.002) for modifier level and (p=0.006) for innovator competency level. Therefore, the null hypothesis was rejected implying that the more the years of nurses' experience at work the higher their level of competency is likely to be in the utilization of nursing informatics. However, the r values were negative indicating an inverse relationship between the years of experience and levels of competency.



**Table 4.** Correlation Result of the Relationship between Nurses' Years of Experience and Levels of Competency

Competency level	R value	P value	Remark
User	-0.104	0.001	Significant
Modifier	-0.164	0.002	Significant
Innovator	-0.146	0.006	Significant

### 3.6 Relationship between Age and Levels of Competence

A significant relationship was found between age and each of the levels of competence, the p values across these levels were less than 0.05; p= 0.017 for user level, p=0.003 for modifier level and p=0.028 for innovator level of nursing informatics competence.

**Table 5.** Cross Tabulation of Age and Levels of Competence

Competency level	Age		Test of Statistical Significance
	20-39 n (%)	40-59 n (%)	
<b>USER</b>			
Novice	13 (6.2)	10 (7.1)	X <sup>2</sup> = 10.218 df= 3 p = 0.017
Beginner	93 (44.5)	85 (60.3)	
Competent	87 (41.6)	41 (29.1)	
Proficient	16 (7.7)	5 (3.5)	
<b>MODIFIER</b>			
Novice	25 (12.0)	32 (22.7)	X <sup>2</sup> = 13.980 df= 3 p = 0.003
Beginner	81 (38.8)	64 (45.4)	
Competent	84 (40.2)	33 (23.4)	
Proficient	19 (9.1)	12 (8.5)	
<b>INNOVATOR</b>			
Novice	28 (13.4)	35 (24.8)	X <sup>2</sup> = 9.070 df= 3 p = 0.028
Beginner	100 (47.8)	61 (43.3)	
Competent	67 (32.1)	33 (23.4)	
Proficient	14 (6.7)	12 (8.5)	

## 4 Discussion

The respondents were between age twenty (20) and fifty nine (59) years. This findings, corroborating Raja, Mahal, and Masih's [15] findings among nurses in hospitals in Ludhiana, India implies that the respondents were young, still within active age of government service and have more years to spend in professional practice. More anticipatory years of career growth in professional practice by young nurses makes demand for appropriate competence in informatics for efficiency and effectiveness in contemporary health care system moderated by technology. The study also revealed that majority of the respondents were females, still affirming the Royal College of Nursing [16] submission that conventionally, nursing is a female-dominated profession but there is need for the best of people from both genders to come into the profession.

The findings from this study, which showed that majority of nurses had fair knowledge of nursing informatics, could be said to be the effect of the recent inclusion of basic computer knowledge into the nursing education curriculum. The application of this with regards to nursing informatics in practice has not been well established. However, the result of a study by Raja et al. [15] in India revealed that majority

of the nurses had good computer knowledge. Effort should therefore be made to improve nurses' knowledge on nursing informatics, as this will go a long way to advance their competency in its utilization.

Majority of the nurses rated themselves as 'not competent' in the utilization of nursing informatics within each level of competency, this pattern of competence was similar across the three levels of health care facilities and it corroborates the findings in the study of Hwang and Park [17] on factors associated with nurses' informatics competency, which revealed that majority of the respondents considered their informatics competency to be below average. This finding is not unexpected, it may be traced to the insufficient knowledge exhibited by the respondents on nursing informatics. With these findings, it could be concluded that most of the nurses ( $\geq 60\%$ ) in this study could be categorized as either novice or beginners; this has a lot of implications for nurse administrators and managers. For nurses across the three level of care to move to the higher level within the context of the novice to expert theory (competent-expert), there is need for rigorous skill development for the nursing workforce in the use of nursing informatics to document and facilitate continuity of care.

A significant relationship was found between age and each of the levels of competency, this is not surprising because the younger generation of nurses are more receptive and exposed to technology than the older generation, however the older nurses are also encouraged to be more receptive to the use of technology to help in meeting the challenge of the 21st century in providing quality healthcare.

The study revealed an inverse relationship between nurses' years of experience and their competency in nursing informatics. This finding is anticipated due to the recent introduction of the 'use of computer' as a course into the nursing education curriculum, of which the older nurses may not have had requisite exposures to ICT knowledge and application.

Several reasons were presented as barriers to utilization of nursing informatics in practice across the health care facilities. Out of the thirteen listed barriers, the most perceived in the three levels of healthcare facilities was inadequate computers as reflected in Figure 2. Though lack of computer is a major barrier but the study also revealed that the respondents' knowledge is inadequate, the first challenge to resolve is the issue of inadequate knowledge which will empower the nurses to advocate for computers and other equipment needed for utilization of nursing informatics. A previous study by Hegney et al. [5] identified a similar result, hence, effort should be made to improve nurses' knowledge, and equipment should be at their disposal if they will ever be able to combat the problem of inadequate computers for utilization of nursing informatics in practice.

There were other barriers highly perceived by the respondents which are; too many work demand and shortage of staff which limits the time available for utilization of nursing informatics. This is not unanticipated in a developing country like Nigeria as most health facilities are short staffed. However, this is not the case in the Australia study by Hegney et al. [5] which reported that 'work demands' was less of a barrier in community health and in other public sector areas where it is speculated that information technology is seen by nurses and their employers to be an integral part of the role. Lack of encouragement by hospital management is another barrier identified by nurses to utilization of nursing informatics, this is in support of the findings of Estabrooks et al. [18] that barriers to internet use in the clinical setting include lack of administrative support, negative attitudes toward computer technology, lack of expertise and time constraints in the workplace. It is apparent from the results of this study that barriers vary from one health facility to another. Thus a single approach to overcoming the barriers identified in this report may not resolve the barriers. For competency in utilization of nursing information to increase in nursing, action must be taken on each of the barriers identified in this study regardless of the percentage of its occurrence in the various health care facilities.

#### 4.1 LIMITATION TO THE STUDY

The major limitation of this study is the use of a self-report for measuring perceived competency which had the potential of yielding bias responses. This could have potentially affected results from this study and a more objective observation may yield different findings. Competency level as expert was not evaluated because this level requires advance education in Nursing Informatics at the Masters level and none of the institutions that offer postgraduate nursing degree in Nigeria currently offers postgraduate degree in Nursing Informatics. On the other hand none of the health facilities currently employ nurses who specialize in Nursing Informatics.

## 4.2 IMPLICATION FOR NURSING PRACTICE

Despite the advancement in nursing practice as a result of nursing informatics in the developed countries, the reverse is the situation in Nigeria according to the report of this study. The study has also shown that nurses' knowledge of nursing informatics was only fair, with greater percentage rating themselves as 'not competent' coupled with various barriers limiting their competencies

These findings have great implication of poor nursing care of patients and can affect the continuity of care. There is also a tendency for nurses to lag behind while other health professionals move with the pace of 21st century in health care delivery. It is therefore imperative to address the limiting factors that were identified as it will promote increase competency in the utilization of nursing informatics in nursing practice.

As reviewed earlier in the literature, nurses are expected to provide safe, competent, and compassionate care in an increasingly technical and digital environment. To achieve this, there is a need for improving nurses knowledge in nursing informatics, resolving the issue of limited resources, and responding to various challenges as have identified, also nurses must be encouraged using diverse means to be willing users and creative operators of nursing informatics to improve the quality and safety of patient care. Essentially, specialization in nursing informatics must be seen as priority need in nursing education to have experts that will drive deployment of nursing informatics for quality nursing care in Nigeria in the 21st century.

## 5 Conclusion

The study concluded that nurses' knowledge of nursing informatics was just fair while majority rated themselves as 'not competent' in the use of nursing informatics, with various barriers identified.

**Conflict of Interest: We declare that there is no conflict of interest.**

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