ORIGINAL ARTICLE

Configuring a computer-based nursing process form to support nursing diagnosis in rural healthcare clinics in Nigeria

CHINEMEREM ELEKE[1,2], ADA C. NWANERI[3], JOY C. SAMUEL[1], SABINAH NGBALA-OKPABI[1,2], IFEYINWA S. AGU[4], DAMIETE M. AMACHREE[5] and TEX-JACK DOKUBA[6]

[1]Department of Nursing Science, University of Port Harcourt; [2]Africa Center for Excellence in Public Health & Toxicological Research, University of Port Harcourt; [3]Department of Nursing Sciences, University of Nigeria Enugu Campus; [4]Department of Nursing Science, Abia State University Uturu; [5]Department of Nursing Sciences, Rivers State University, Port Harcourt; [6]Rivers State School of Midwifery, Port Harcourt, Nigeria

DOI: 10.4081/jphia.2023.2359

Abstract. Poor internet infrastructure limits the use of computer-based nursing process forms in rural areas. This study aimed to configure a computer-based nursing process form to support nursing diagnosis and care evaluation in rural healthcare clinics in Africa. This study utilized a methodological design. The design process utilized a three-stage procedure involving planning, configuration, and testing. Seven faculty members volunteered to participate in the laboratory verification process. Each simulation session lasted 45 min and span from patient admission to exit. The experts independently scored the software functionality dichotomously as Not Suitable (score 0) and Suitable (score 1) for nursing practice. The agreement between the faculty volunteers was 0.857. The configuration of a readily available Microsoft Access computer application to support nursing diagnosis without internet service is possible. Health facilities in rural areas without internet connectivity should resort to such local configurations to maximize the benefits of electronic-based documentation.

Introduction

Designing mobile technologies requires the amalgamation of scientific knowledge, technical design, and practical ideas towards tool development. The use of mobile technologies in the biomedical field has risen dramatically in the developed world. Nurses use mobile technologies for several activities such as patient assessment, diagnosis, care documentation, treatment evaluation, and data sharing (1). They often use it in hospitals and hospices in technologically advanced countries. Mobile technology utilization in rural Africa is very low due to a lack of reliable internet broadband connectivity (2). Given that nurses deal with enormous daily patient care data, it has become imperative to reshape the nursing work process for effectiveness and efficiency in the rural areas of Africa.

Nurses are supposed to document all planned and completed nursing activities (3). Nursing documentation involves records of planned care delivered to patients and families by qualified professional nurses. In modern times, nurse professionals acknowledge high-quality nursing documentation as essential in professional nursing practice (4). It provides details of patients' progress throughout hospitalization. Technically, documented nursing activities serve as one of the accepted indicators of quality nursing services within a hospital (5). It further supports effective communication of care delivery between health facilities at primary, secondary, and tertiary levels of care (6). On the other hand, inaccurate nursing documentation can result in faulty data analysis, inappropriate nursing care plans, and ineffective patient care interventions (7). As a panacea, nurses apply the nursing process.

The Nursing Process is considered a highly significant practical standard for patient-specific nursing care (8). The idea of the nursing process has been accepted globally by nurses since its proposal by Lydia Hall in 1955 (9). It is central to all nursing actions in any nursing frame of reference (10). It involves accurate assessment, planning of care, intervention, and evaluation of individualized care. It constitutes the foundation for quality scientific nursing practice (11). Nurses use Gordon's Functional Health Patterns in the assessment phase, NANDA-International (NANDA-I) in diagnosis and planning, Nursing Interventions Classification (NIC) in the intervention, and Nursing Outcomes Classification (NOC) in the evaluation. The NANDA-I, NIC, and NOC add up to form a nursing care plan.

The Functional Health pattern is a comprehensive model that provides a holistic format for assessing patients using eleven health patterns. These are questions that reflect the

Correspondence to: Chinemerem Eleke, Maternal & Child Health Informatics and Research Unit, Department of Nursing Science, University of Port Harcourt, Port Harcourt, Rivers State, Nigeria
E-mail: chinemerem.eleke@uniport.edu.ng

Key words: computer, diagnosis, internet, nursing, rural

strengths and limitations of a unique individual patient. Each weakness links to available NANDA-I diagnosis. It then informs the NIC (intervention) and NOC (outcome) categories (12). The NANDA-I, NIC, and NOC are standardized nursing taxonomy or classification systems developed for the International Classification of Nursing Practice (13). These standard nursing languages provide common definitions of nursing concepts and allow for theory-based, comparable, and researchable nursing data to emerge (14). In an attempt to integrate the classification systems, an alliance between NANDA-I and the Centre for Classification and Nursing Effectiveness proposed the NNN (NANDA, NIC, and NOC) structure and linkages. The Nursing process Care Plan is one of the tools utilized during the documentation of the nursing process. It shows what happens in the nursing decision-making process anchored on the patient's presenting information. It stands out as a care tool that guides the sequence of logical reasoning and enables the nursing staff to evaluate their effectiveness and modify their intervention (13). It provides information on admission, diagnosis, plan, interventions, and evaluation (ADPIE) of care. The two accepted forms for holding nursing care plan data are paper-based and electronic-based.

Paper-based nursing process documentation is the most commonly used system in rural Africa. The nurse writes down relevant details of care on paper. As the nurse progresses through the ADPIE steps, he/she refers to voluminous NANDA-I, NIC, NOC taxonomy textbooks to retrieve relevant information to facilitate proper documentation. It can be time-consuming, especially in settings with a high patient-to-nurse ratio (1). In recent times, as nursing has become more complex and the amount of documentation has increased immensely, paper-based hospital documents require more storage space, making it very labor-intensive to assemble and retrieve relevant information (15). In addition, handwriting legibility differences between nurses worsen the risk of misinterpretation of paper documented information during fast-paced nursing emergencies (16). These limitations of paper-based nursing process documentation have stimulated several authors to argue that the use of computerized nursing documentation forms with links to nursing diagnosis will facilitate diagnostic reasoning and reduce time spent on data retrieval.

Electronic-based nursing process documentation is gaining acceptance among nurses (5). It requires an electronic device such as a computer and few digital accessories. It may need a small amount of electricity to operate, a problem increasingly solved by growing rural solar electrification projects. Its documents occupy small storage spaces (18). Depending on the design, it can suggest NANDA-I diagnosis without the nurse referring to voluminous nursing taxonomy textbooks. In theory, this would reduce the time spent on documentation. It could share documents quickly among authorized nursing care providers when connected to an Ethernet (19). In addition, it can search for and retrieve specific relevant data for immediate use and improve the legibility concern.

Enhancing the quality of nursing process documentation is a global challenge. The limitations of paper-based nursing process documentation have led nurse-researchers and software developers into designing nursing process tools. The previous computerized nursing assessment forms in existence are the Nursing Process Electronic Documentation System of the University of Sao Paulo (USP-PROCEnf), Electronic Nursing Process Data Model [ENPDM], Nursing Process Support System in Chinese (NPSSC), and Computer-Aided Nursing (CAN) diagnosis system (20-23). However, the mentioned nursing process software tools have some strengths and weaknesses that limit their fit for purpose in rural African settings. They can suggest nursing diagnoses that the nurse must confirm. However, all the mentioned electronic systems offer a limited list of NANDA-I nursing diagnoses. Gordon's Functional Health Pattern assessment is also not integrated into the forms. They always require the internet to operate, hence not fit for purpose in rural Africa.

In Nigeria, electronic-based nursing documentation is not widespread in rural and semi-rural public healthcare facilities. In disappointment, two of the frequently cited hindrances to implementation include the high cost of purchasing existing nursing process software, lack of internet access, the high price of internet access, and incompatibility with basic computer requirements (24). The set premise highlights the need for a study geared at designing a low-cost and highly compatible computerized nursing process form that can function independently of the internet. This study aimed to configure a computer-based nursing process form to support nursing diagnosis in rural healthcare clinics in Africa.

Materials and methods

Ethical considerations. This study adhered strictly to the provisions of the Helsinki Declaration as revised in 2013. The protocol of this study was independently reviewed and approved by two Health Research Ethics Committees (HRECs) namely: the HREC of Federal Medical Centre Umuahia (FMC/QEH/G.596/Vol. 10/562) and the HREC of Federal Medical Centre Owerri (FMC/OW/HREC/Vol. II/66). All volunteer participants in this study provided signed consent before participation commenced. This research report referenced the NANDA-I taxonomy textbook used in this study and cited the authors Herdman and Kamitsuru (25).

Study design. A methodological design was utilized in this study. This design focuses on the development of tools via sophisticated technical methods. It is appropriate for scientific disciplines studying complex phenomena like health and behaviour as seen in nursing (26).

Procedure. The research team designed this supposedly low-cost software for rural healthcare settings experiencing unreliable internet services. A three-stage system development life cycle process comprising planning, configuration, and testing as advocated by Peres and colleagues was applied (20). All identified anomalies in the testing stage stimulated restarting the cycle (review).

Stage 1: planning. The team designed a flow chart to illustrate the sequence of activities and flow of information (Fig. 1). The flow chart was intended to guide the algorithm development that will link real-world experience to computational logic. Due to limited available engineering software resources, the researcher used Microsoft Word 2007 (Microsoft Corporation,

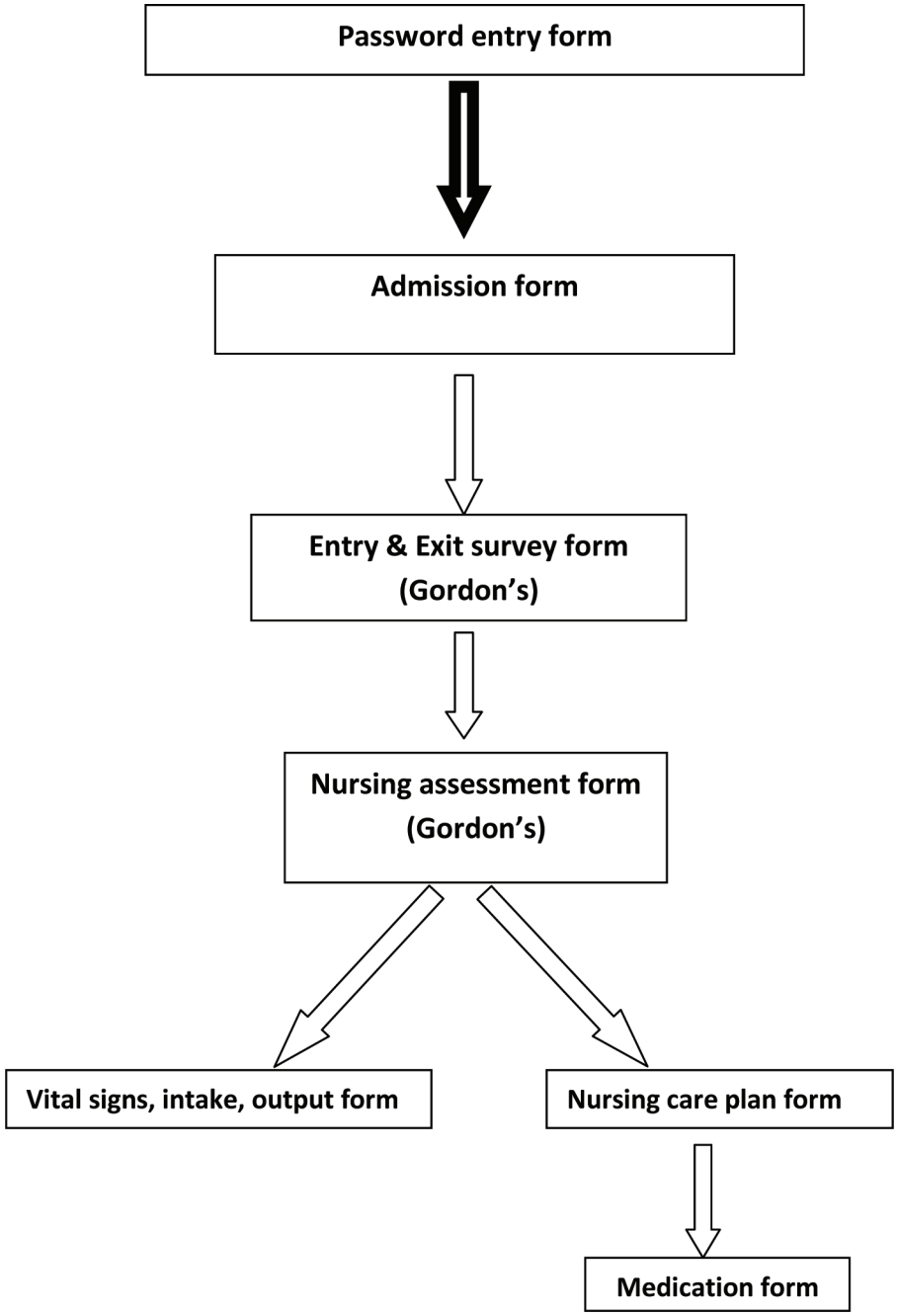

Figure 1. ENPDF information flow chart.

Redmond, USA) by convenience for designing the flow chart. The planning stage took place in April 2022. The planning was based on results of qualitative communication between the researcher and clinical nurses on required features of an ideal electronic nursing process form.

Stage 2: configuration. The team converted ideas in the flow chart to screen images. The screen interface and layout was designed with Microsoft Access 2007 (Microsoft Corporation, Redmond, USA) by convenience. Firstly, we created database tables. A nursing diagnosis table was designed and populated using the NANDA-I 2015-2017 edition (25). The table was cross-checked four times to ensure the identification and correction of all textual mistakes. The functional patterns table was created to show fields for data entry on Gordon's eleven patterns (26). The additional tables created include those on patient registration profile, nursing entry survey, nursing exit survey, vital signs, intake, output, nursing care plan, and medication. Then a password table was made. Secondly, the tables were converted into forms to include admission, nursing entry-exit survey, nursing assessment, vital signs-intake-output, nursing care plan, and medication forms (Figs. 2-7). A password entry form was also made. Thirdly, modelling of the software was done via programming functions. The tables were linked using the table relationship function. The fields were linked using the query function. For the nursing diagnosis prediction in the nursing care plan form, clicking to select an item from a drop-down menu on the problem domain informs the computer to query and suggest a menu of items in the problem class. A click to select an item

in the problem class will tell the system to query and present a list of problem items. The suggestions are automatic and need the nurse to confirm a selection to trigger each next step. Finally, the password entry field was programmed to match any typed-in digits with preregistered passwords in the password table before granting access. The configuration was done between May and July 2022.

Step 3: testing. The software was installed on a laptop with the following features: Intel Pentium HP 250 G2, 1600MHz DDR31 SDRAM 4GB memory. Engineering verification was done by the research team. The smooth flow of navigation links through the separate forms that comprise the computer-based nursing process form was verified as satisfactory. Laboratory testing was done with the help of seven faculty members. It was done in a simulation setting inside the University of Port Harcourt Department of Nursing Demonstration and Simulation Laboratory. The seven faculty members took turns on the computer to verbally assess a volunteer and document data on the software. Each simulation session lasted 45 min and span from patient admission to exit. At the end of each session, the software operator (volunteer faculty) was requested to dichotomously write Not Suitable (score 0) and Suitable (score 1) for Nursing practice in line with their feeling about the functionality of the software. The feedback was anonymously returned to the team in a mail box. No clinical validation was done. However, after relevant approvals are received from authorities, the research team will progress to clinical testing in the real world.

Data analysis. To determine the agreement between the participating faculty regarding the software, all responses (Not Suitable=0 and Suitable=1) were summed and divided by the total number of faculty participants. The Statistical Products and Service Solution version 21 was used for the statistical calculation (SPSS 21, IBM Corp., Armonk, USA).

Results

Six of the seven faculty members responded with a score of 1. The agreement between the faculties was computed to be 0.857, so the software was considered useful for nursing practice (27).

Discussion

The configuration of readily available computer applications to support nursing diagnosis and the nursing process can be a viable solution for nursing practice in rural communities. Considering how voluminous the nursing taxonomy textbooks are, a lack of familiarity with its content can lead to delay and error in care (28). This software functions well without internet connectivity. It is also compatible with basic computer and mobile electronic devices. The research team named the computerized-form ENPDF (an acronym for Electronic Nursing Process and Documentation Form). It was designed to function in line with a flow chart constructed for this study. In the flow chart, the research team utilized a simple visual representation of the information flow. This was done to ensure easy understanding of the information flow at a glance. Given the premise that the adoption of new technology is not very straightforward, a flow chart could serve as an orientation tool for new users.

The ENPDF was composed of the following sub-forms namely Admission form, Nursing Entry and Exit survey form, Nursing Assessment form (based on Gordon's Functional Health Pattern), Vital Signs-Intake-Output Form, Nursing Care Plan and Treatment form (linked electronically to NANDA-I Diagnosis Domains 2015-2017 edition), and Medication form. The admission form comprised fourteen data fields and eight function tabs. The fourteen data fields were designed to hold information such as a unique folder number, date of admission, first name, middle name, surname, gender, age, phone number, residence, email, work address, next of kin's full name, phone number, and address. The eight function tabs were designed to search for a patient's record, print form, submit/save patient's information, find the first record, previous record, next record, last record, and open entry and exit survey form (Fig. 2). The end-user forms were designed to have very bold form titles. This was done to familiarize the end user of what position in the flow chart he/she is at a specific time.

The nursing entry and exit survey forms were composed of two sections put side by side for easy visualization and analysis. The two sections are the nursing entry survey form (on the left) and the nursing exit survey form (on the right). The nursing entry survey form was designed to be filled on assessment of an admitted patient, whereas the nursing exit survey form was designed to be filled during summative discharge evaluation. The nursing entry survey form comprised ten data fields and nine function tabs. The eleven fields were designed to hold information such as folder number, unique entry survey identification string, admission date, entry nutrition status, entry elimination status, entry mobility status, entry sleep status, entry sexuality status, and entry general health status. The entry status fields were graded using a drop-down NOC (Nursing Outcomes Classification) evaluation scale such that very good=1/5, good=2/5, fair=3/5, bad=4/5, and very bad=5/5. The nine function tabs were designed to perform functions such as searching nursing entry and exit survey form, find the next record, print the nursing entry and exit survey form, find the first record, find the previous record, find the next record, find the last record, submit/save entry survey, and open nursing assessment form. Furthermore, the nursing exit survey form comprised eight data fields and one function tab. The eight data fields were designed to hold data on date of discharge, exit nutrition status, exit elimination status, exit mobility status, exit sleep status, exit memory status, exit sexuality status, and exit general health status. Additionally, the function tab was designed to submit/save exit survey records (Fig. 3). Colors were also applied to certain fonts to minimize visual pollution (29). It offers a digitized link to Gordon's Functional Health Patterns form which existing Nursing process software does not offer. This additional utility is expected to enhance efficiency in communication documentation.

The nursing assessment form is based on Gordon's Functional Health Pattern. It comprised fifteen data fields and nine function tabs. The fifteen data fields were designed to hold information on entry survey identification string,

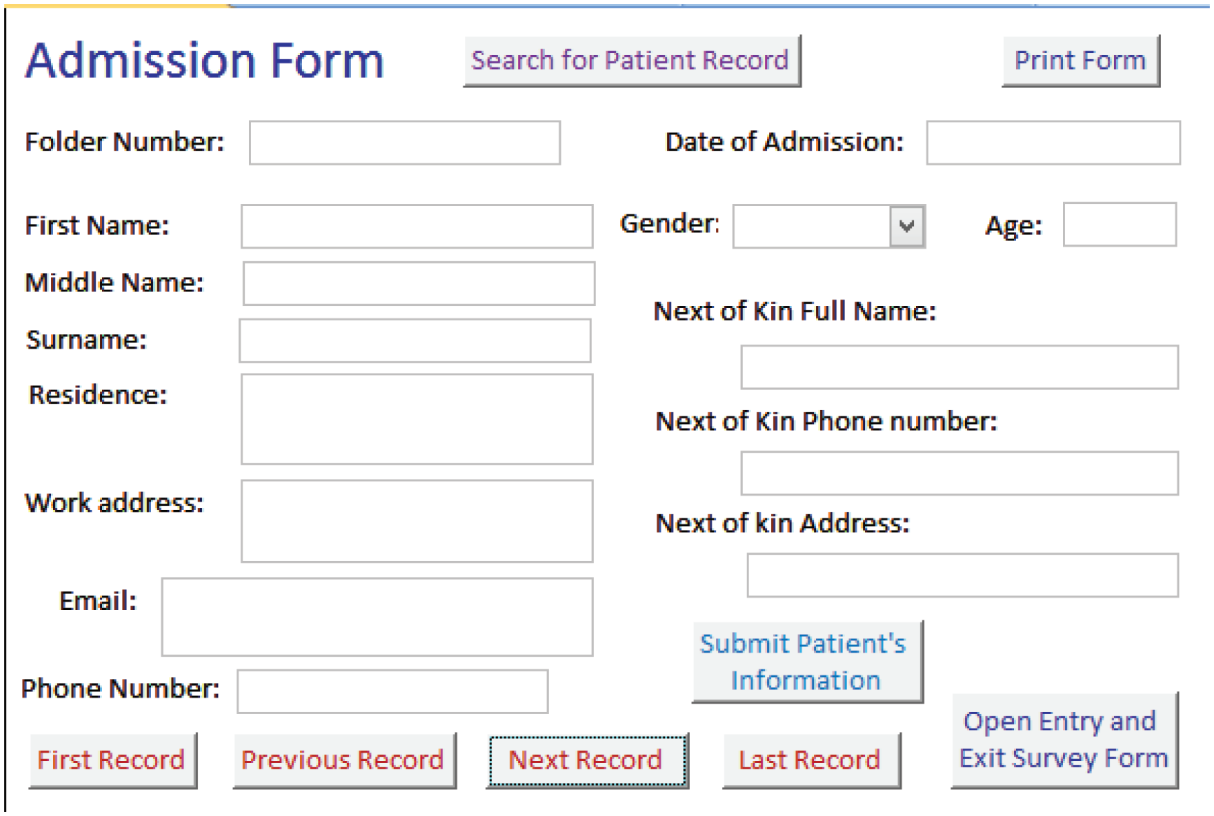

Figure 2. Admission form.

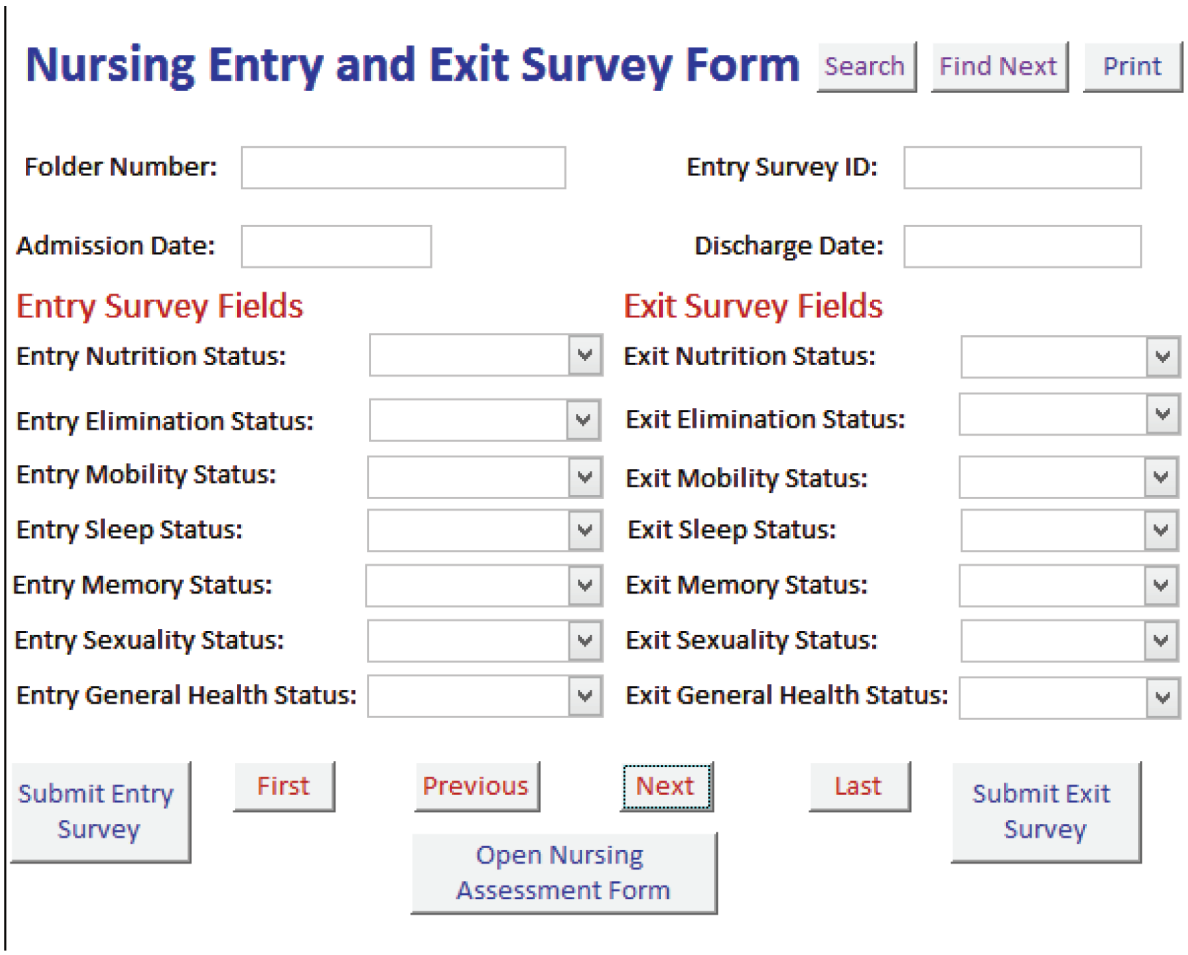

Figure 3. Nursing entry and exit survey form.

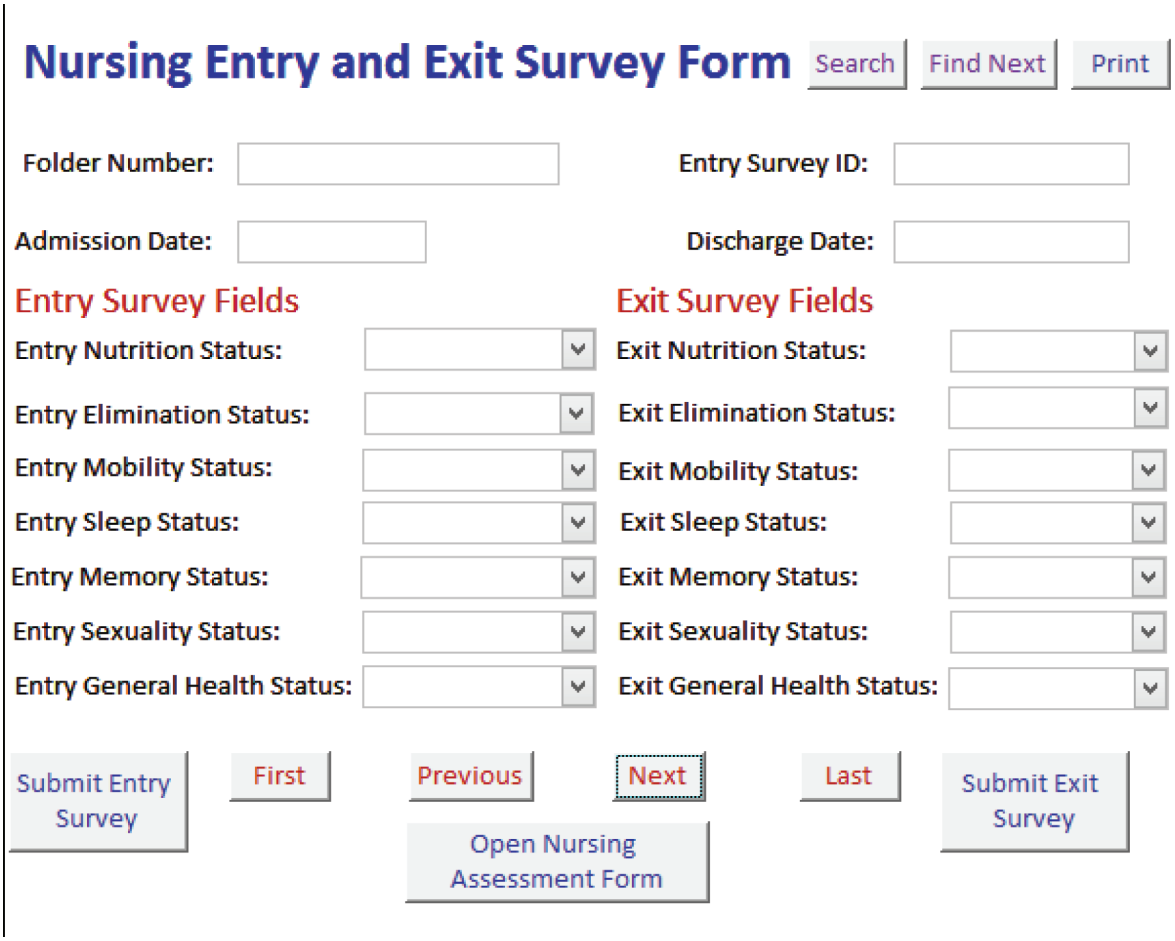

Figure 4. Nursing assessment form.

unique nursing assessment identification string, health management, nutrition, elimination, mobility, cognition, sleep, self-concept, role satisfaction, sexuality, coping, belief, the signature of nurse, and date of assessment. The nine function tabs were designed to search the nursing assessment form, find the next record, print the assessment form, find the first assessment, find the previous assessment, find the next assessment, find last assessment, save assessment record, and open nursing care plan (Fig. 4). The arrangement of tabs is expected to enable a more efficient surfing of the assessment form.

The nursing assessment form is based on Gordon's Functional Health Pattern. It comprised fifteen data fields and nine function tabs. The fifteen data fields were designed to hold information on entry survey identification string, unique nursing assessment identification string, health management, nutrition, elimination, mobility, cognition, sleep, self-concept, role satisfaction, sexuality, coping, belief, the signature of nurse, and date of assessment. The nine function tabs were designed to search the nursing assessment form, find the next record, print the assessment form, find the first assessment, find the previous assessment, find the next assessment, find last assessment, save assessment record, and open nursing care plan (Fig. 4). This all in one page construction was intended to enable a more detailed analysis and comparison of the entry survey and Gordon's assessment.

The vital signs-intake-output form comprised twenty fields and six function tabs. The twenty fields were designed to hold information on objective nursing assessment such as temperature, pulse, blood pressure, fluid intake, and fluid output readings. The six tabs were designed to search for specific data on the form, go to the next record, go to the first record, go to the previous record, go to the last record, and save the existing record (Fig. 5). This will document and maintain the patient's health monitoring needs.

The nursing care plan and treatment form comprised seventeen data fields and 8 function tabs. The seventeen data fields were designed to hold information on nursing assessment identification string, unique care plan form identification string, date of nursing treatment, objective examination, the domain of problem (NANDA-I), class of problem (NANDA-I), nursing diagnosis-problem (NANDA-I), nursing diagnosis-related to, nursing diagnosis-evidenced by, nursing goal, intervention, evaluation, evaluation score (NOC), problem status, patient's admission status, and date of discharge. The data fields for the domain of the problem, class of problem, and nursing diagnosis-problem were designed in such a way as to enable the software to suggest related options in line with NANDA-I terminology 2017 edition (25). The eight function tabs were designed to execute tasks such as print nursing care and treatment sheet, search nursing care and treatment sheet, find first treatment form, find previous treatment form, find next treatment form, find last treatment form, submit/save the treatment,

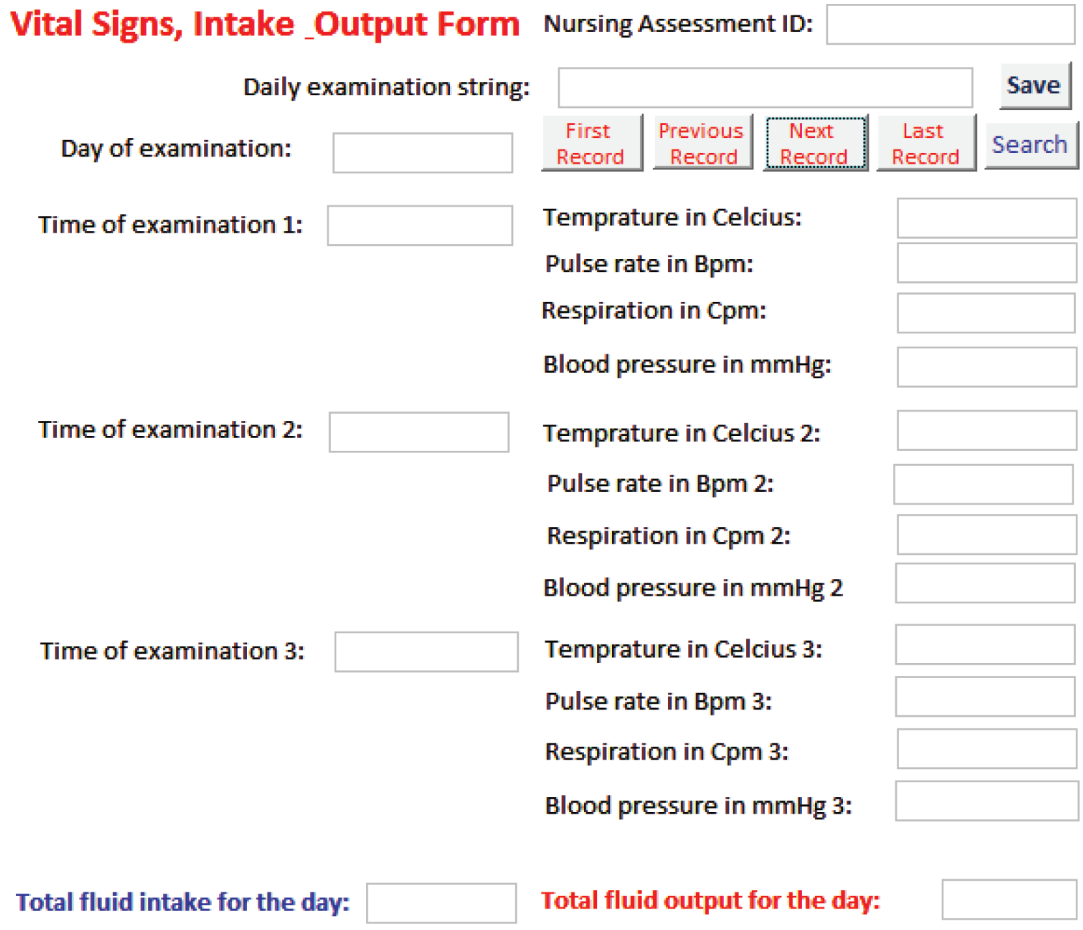

Figure 5. Vital signs-intake-output form.

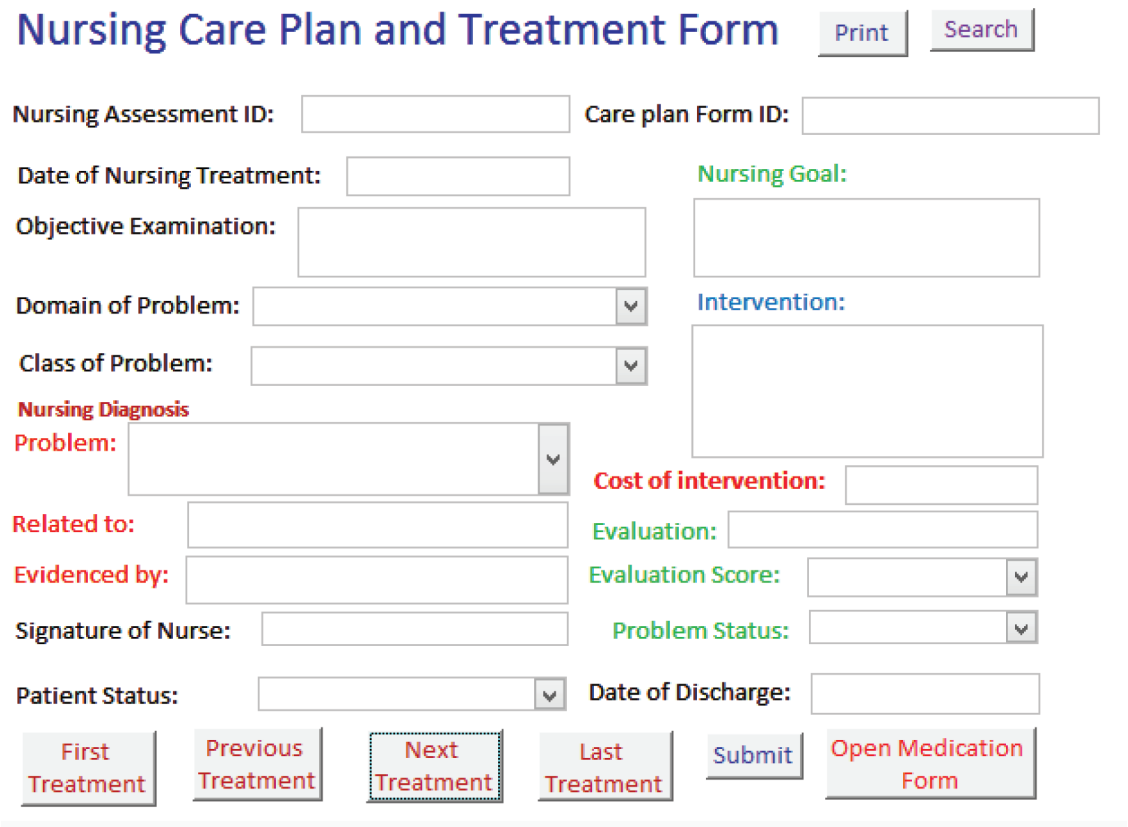

Figure 6. Nursing care plan and treatment form.

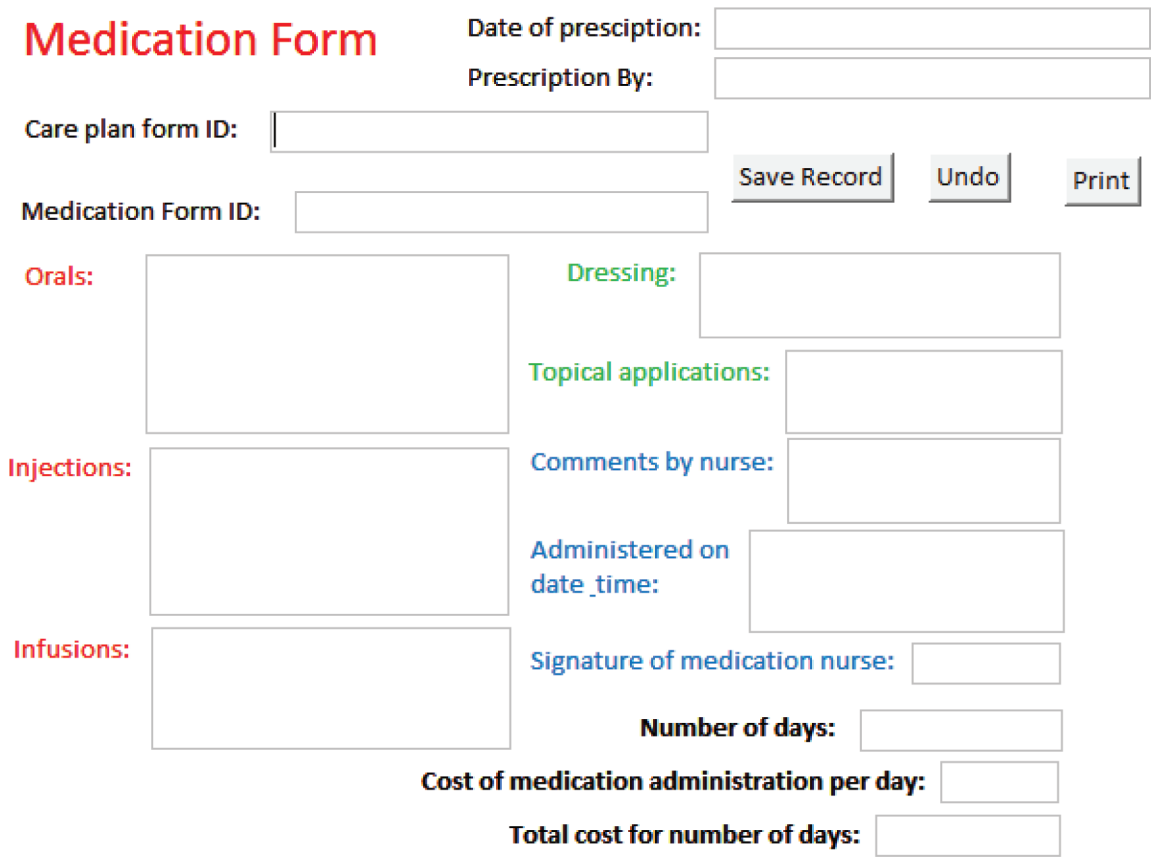

Figure 7. Medication form.

and open medication form (Fig. 6). The ability of this software to suggest nursing diagnosis is expected to make nursing care planning and delivery more accurate, timely, and objective.

The medication form comprised ten data fields and three function tabs. The data fields were designed to hold information on the date of prescription, details of prescriber, care plan form identification string, unique medication form identification string, orals, injections, infusions, dressing, topical applications, and comments by the nurse. The function tabs were designed to save medication records, print medication form, and undo to permit prescription adjustment (Fig. 7). This is expected to add to documenting and minimizing medication errors.

Limitations

The strength of this product is that it requires no internet connection to work properly. However, the limitations are that this software configuration has not been tested in the real world for clinical validity and usability. It is still a prototype that may still undergo modifications in the future.

Conclusions

The configuration of readily available computer applications to perform nursing-related operations is possible. The research team successfully configured one novel ENPDF software using the most available basic computer resources. A non-internet-based automated NANDA-I diagnosis suggesting application has untapped potentials in supporting nursing decision making. Health facilities in rural areas without internet connectivity could resort to the locally configured systems to maximize the benefits of electronic-based documentation.

Acknowledgments

The authors thank the faculties from the Department of Nursing Science, University of Port Harcourt who volunteered to participate in this study.

Funding

None.

Ethical approval and consent to participate

This study adhered strictly to the provisions of the Helsinki Declaration as revised in 2013. The protocol of this study was independently reviewed and approved by two Health Research Ethics Committees (HRECs) namely: the HREC of Federal Medical Centre Umuahia (FMC/QEH/G.596/Vol. 10/562) and the HREC of Federal Medical Centre Owerri (FMC/OW/HREC/Vol. II/66).

Availability of data and materials

All data generated during this study can be provided upon reasonable request.

Informed consent

All volunteer participants in this study provided signed consent before participation commenced.

Contributions

ACN, CE, conception; CE, JCS, SN-O, DMA, T-JD, data collection, data analysis; ACN, CE, JCS, SN-O, DMA, T-JD, data interpretation; ACN, ISA, design of study; ACN, ISA, DMA, critical revision of manuscript; CE, configuration of software; CE, JCS, SN-O, T-JD, drafting of manuscript. All the authors approved the final version to be published.

Conflict of interest

The authors declare no potential conflict of interest.

Accepted: 23, November 2023; submitted: 21, October 2022.

References

1. Ahn M, Choi M and Kim Y: Factors associated with the timeliness of electronic nursing documentation. Healthc Inform Res 22: 270-276, 2016.
2. Adedeji P, Irinoye O, Ikono R and Komolafe A: Factors influencing the use of electronic health records among nurses in a teaching hospital in Nigeria. J Infect Dev Ctries 12: 174, 2018.
3. Meißner A and Schnepp W: Staff experiences within the implementation of computer-based nursing records in residential aged care facilities: A systematic review and synthesis of qualitative research. BMC Med Inform Decis Mak 14: 54, 2014.
4. Park H, Cho H and Kim H: Development of an evidence-based nursing process system to improve clinical decision making with colorectal cancer nursing diagnosis. J Korea Multimedia Society 19: 1197-1207, 2016.
5. Akhu-Zaheya L, Al-Maaitah R and Bany Hani S: Quality of nursing documentation: Paper-based health records versus electronic-based health records. J Clin Nurs 27: e578-e589, 2018.
6. Noureldin M, Mosallam R and Hassan SZ: Quality of documentation of electronic medical information systems at primary health care units in Alexandria, Egypt. East Mediterr Health J 20: 105-111, 2014.
7. Paans W and Müller-Staub M: Patients' Care Needs: Documentation analysis in general hospitals. Int J Nurs Knowl 26: 178-186, 2015.
8. Khatiban M, Tohidi S and Shahdoust M: The effects of applying an assessment form based on the health functional patterns on nursing student's attitude and skills in developing the nursing process. Int J Nurs Sci 6: 329-333, 2019.
9. Ojewole F and Samole A: Evaluation of nursing process utilization in a teaching hospital, Ogun State, Nigeria. J Nurs Midwifery Sci 4: 97-103, 2017.
10. Asmirajanti M, Hamid AYS and Hariyati RTS: Nursing care activities based on documentation. BMC Nurs 18 (Suppl 1): S32, 2019.
11. Baraki Z, Girmay F, Kidanu K, Gerensea H, Gezehgne D and Teklay H: A cross sectional study on nursing process implementation and associated factors among nurses working in selected hospitals of Central and Northwest zones, Tigray Region, Ethiopia. BMC Nurs 16: 54, 2017.
12. Eun K and Hyang-sook S: Construction and application of nursing information system using NANDA-NOC-NIC Linkage in medical-surgical nursing units. Korean J Adult Nurs 25: 365-376, 2013.
13. Dal Sasso GT, Barra DC, Paese F, de Almeida SR, Rios GC, Marinho MM and Debétio MG: Computerized nursing process: Methodology to establish associations between clinical assessment, diagnosis, interventions, and outcomes. Rev Esc Enferm USP 47: 242-249, 2013 (In Portuguese).
14. Wang N, Björvell C, Hailey D and Yu P: Development of the quality of australian nursing documentation in aged care (QANDAC) instrument to assess paper-based and electronic resident records. Australas J Ageing 33: E18-E24, 2014.
15. Coffey C, Wurster LA, Groner J, Hoffman J, Hendren V, Nuss K, Haley K, Gerberick J, Malehorn B and Covert J: A comparison of paper documentation to electronic documentation for trauma resuscitations at a level I pediatric trauma center. J Emerg Nurs 41: 52-56, 2015.
16. Albarrak AI, Al Rashidi EA, Fatani RK, Al Ageel SI and Mohammed R: Assessment of legibility and completeness of handwritten and electronic prescriptions. Saudi Pharm J 22: 522-527, 2014.
17. Kruse CS, Kristof C, Jones B, Mitchell E and Martinez A: Barriers to electronic health record adoption: A systematic literature review. J Med Syst 40: 252, 2016.
18. Nguyen L, Bellucci E and Nguyen LT: Electronic health records implementation: An evaluation of information system impact and contingency factors. Int J Med Inform 83: 779-796, 2014.
19. Zega M, D'Agostino F, Bowles KH, De Marinis MG, Rocco G, Vellone E and Alvaro R: Development and validation of a computerized assessment form to support nursing diagnosis. Int J Nurs Knowl 25: 22-29, 2014.
20. Peres H, Lima AFC, da Cruz D de ALM, Gaidzinski RR, Oliveira NB, Ortiz DCF, e Trindade MM and Tsukamoto R: Assessment of an electronic system for clinical nursing documentation. Acta Paul Enferm 25: 543-548, 2012.
21. Bernhart-Just A, Lassen B and Schwendimann R: Representing the nursing process with nursing terminologies in electronic medical record systems: A Swiss approach. Comput Inform Nurs 28: 345-352, 2010.
22. Yeh SH, Jeng B, Lin LW, Ho TH, Hsiao CY, Lee LN and Chen SL: Implementation and evaluation of a nursing process support system for long-term care: A Taiwanese study. J Clin Nurs 18: 3089-3097, 2009.
23. Kurashima S, Kobayashi K, Toyabe S and Akazawa K: Accuracy and efficiency of computer-aided nursing diagnosis. Int J Nurs Terminol Classif 19: 95-101, 2008.
24. Gusen J, Ajayi A and Abubakar AR: Perception and utilization of standadised electronic health records among nurses in Jos UniversityTeaching Hospital, Plateau State, Nigeria. Int J Med Health Res 2: 76-83, 2016.
25. Herdman H and Kamitsuru S: NANDA International Nursing Diagnoses: Definitions and classification 2015-2017. Wiley Blackwell, 2014.
26. Gordon M: Manual of nursing diagnosis. Jones & Bartlett, 2014.
27. Polit D and Beck C: Nursing research: Generating and assessing evidence for nursing practice. 11 edtion. Wolters Kluwer, 2020.
28. Lima JJ, Vieira LGD and Nunes MM: Computerized nursing process: Development of a mobile technology for use with neonates. Rev Bras Enferm 71: 1273-1280, 2018.
29. Silva Kde L, Évora YD and Cintra CS: Software development to support decision making in the selection of nursing diagnoses and interventions for children and adolescents. Rev Lat Am Enfermagem 23: 927-935, 2015.