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Testing a program on Nursing Information System (NIS) for Computer Generated Nursing Care plan

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ABSTRACT

An evaluative study to test the program on Nursing Information System (NIS) for computer generated nursing care plan was carried out in the selected areas of hospitals, Karnataka, India by applying the theoretical framework of Orlando's Theory of Deliberative Nursing Process. The accuracy and reliability of the developed NIS was tested through task-oriented exploration (alpha testing) and further testing among large sized samples viz beta testing. Based on the findings it was concluded that a program on NIS for computer generated nursing care plan is a valuable tool to facilitate nursing care and related documentation activities in the form of individualized nursing care plan for the patient conditions.

Keywords: -Nursing Information System; Computerized nursing care plan; System usefulness; Information quality; Interface quality

I. INTRODUCTION

The twenty first century has witnessed the phenomenal explosion of knowledge and application of communication cum information technologies, accelerating the access to knowledge. Health care reform has created a new approach to health care delivery that calls for an increased importance on the outcomes of patient care services and has expressed a strong commitment to measuring and evaluating outcomes in terms of economic, clinical, and humanistic outcomes (Usha P, 2003). The computer revolution and information technology have transformed modern health care systems in the areas of communication, teaching, storage and retrieval of health care information. These developments have positively impacted patient management, training and retraining of healthcare providers (Bello IS, 2010). In the current scenario there is no information system for computerized nursing care plan is available in Indian setting, the present study is the preliminary attempt to develop a nurse friendly program on Nursing Information System (NIS) for computer generated nursing care plan and to test its usefulness in the clinical setting. Having NIS will improve the quality of nursing documentation, enable consistent nursing audit and promote effective outcome of client care.

II. METHODOLOGY

Computer System Usability Questionnaire (CSUQ) - a self-administered survey instrument developed at IBM to assess user satisfaction with system usability was adopted to test the usability of NIS. The tool was found to be appropriate to assess the various constructs of developed NIS such as system usefulness, information quality, interface quality, overall usability and satisfaction. These scales have been validated in previous research studies and exhibited desirable psychometric properties. The CSUQ has shown strong evidence of reliability ($\alpha = .95$) and an estimated coefficient alpha was 0.93 for System Use, 0.91 for Information Quality and 0.89 for Interface Quality indicating acceptable scale reliability (Lewis JR, 1995).

Testing the usability of NIS to generate a computerized nursing care plan

The accuracy and reliability of the NIS to generate nursing care plan was tested through task-oriented exploration. It includes alpha testing, regression testing based on case scenarios and beta testing through real time data entry by nurses using the NIS. Various constructs of the developed NIS have been examined by applying CSUQ.

III. ALPHA TESTING

The programming team and system analysts carefully desk check the program in a process called “alpha testing”. The purpose of alpha testing is to see if all the processes appear to be functioning as specified in the flow chart, functional specifications, and design specifications (McHugh ML, 2006). Alpha testing has been carried out to test the flow and functioning of the system as per the pre-determined criteria.

After obtaining formal permission from the concerned authorities, the researcher formulated the case scenarios of selected medical conditions from the patient records and interviews; applied same to selected nurses by purposive sampling technique. The researcher taught the process and functioning of developed NIS by demonstrating the function of each tab as well as program sequencing in a systematic manner with the help of LCD projector and the subjects are asked to practice with the system by entering the data and checking the flow of program. After successful completion of practice session each subject are asked to develop a two-nursing care plan with the case scenarios supported by the NIS. After the completion of task, the researcher administered the CSUQ to assess the usability of the developed NIS. The participants were encouraged to verbalize their thoughts if they were uncertain about how to do the above task with the NIS.

IV. REGRESSION TESTING

The problems encountered and difficulties expressed by the nurses were listed out and rectified before proceeding to the second phase of testing through regression testing (McHugh ML, 2006). Based on the outcomes of alpha testing and as per the thumb rules of program testing, with the help of technical expert the NIS has been modified with required specifications, then again, the system has been tested for the functionality and other malfunctioning by the researcher with the help of programmer.

V. BETA TESTING

In this level of testing the program is installed in user environment and further programming of screen formats and other user interface functions is performed. Some users are trained to use the system and users begin the final testing phase by entering real data and checking that the system products are accurate and complete (Tsirintani M,2004). In the present study sixty staff nurses were involved to carry out beta testing. The following tasks of nurses such as opening of DBMS-NCP main page, entering the password, navigation of transaction tab selecting admission tab and entering the patient information in the admission form, navigating to medical diagnosis combo and selection of one medical diagnosis from the combo, navigating to assessment data and selection of assessment data from the dropdown list, selection of appropriate nursing diagnosis from the dropdown list of proposed nursing diagnoses, proceeding to intervention bundles and selection of appropriate ongoing assessment and therapeutic interventions, navigating to the outcome tab and entering the expected outcome and then finally proceeding to manage data tab for reviewing the generated care plan, saving and printing. After the session the researcher assessed the usability of the developed NIS for computer generated nursing care plan.

VI. FINDINGS AND DISCUSSION

The technique adopted to test the usability of NIS in the present study was consistent with the research study of (Rogers ML, et.al, 2013), applied a scenario-based evaluation based on "think-aloud" protocol technique facilitated the researcher to understand the barriers and facilitators of nurses to use NIS and evidenced that usability testing was helpful to understand how nurses use the NIS and their perspective on the system

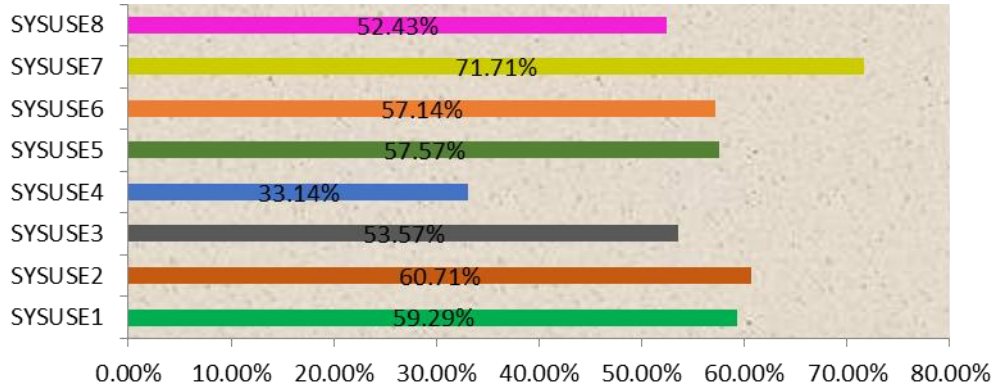

Fig 1: Distribution of system usefulness among nurses

The overall mean system usability obtained by the subjects was 31.18 (55.68%) ± 3.21. It indicated that program on NIS was more useful among the selected nurses in developing computerized nursing care plan.

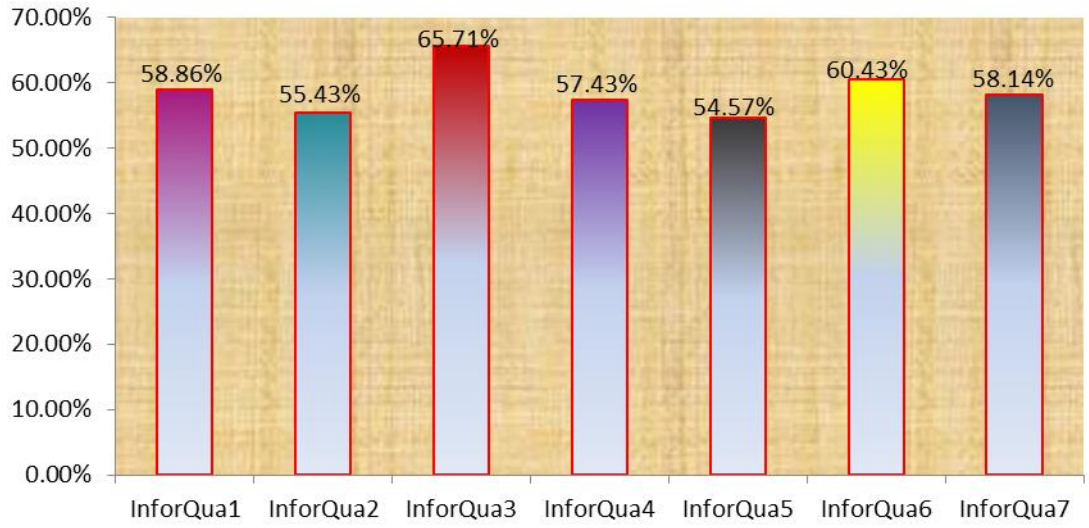

Fig 2: Distribution of information quality among nurses

In relation to information quality the overall mean score obtained by the subjects was 28.73 (58.63%) ± 2.72 and showed that acceptance of new information systems and its successful adoption were enabled through accurately prepared and easily understandable information about NIS which creates a positive perception towards the system among the end users. The findings were consistent with the usability research findings which applied an extended Technology Acceptance Model (TAM) to determine students' intention to use e-resources found that information quality and system quality had significantly influenced the behavior intention of the subjects to adopt e-resources and also beneficial for diagnosing problems of system design, development, and implementation (Tao D, 2008).

Table 1: Mean and SD of interface quality among nurses N=60

Interface Quality	Min Score	Max Score	Max Possible Score	Mean	Mean %	SD
$INTERQUA_1$	3	5	7	4.32	61.71	0.50
$INTERQUA_2$	0	4	7	3.90	55.71	0.54
$INTERQUA_3$	0	5	7	3.71	53.00	0.69

Examining of interface quality of NIS showed that various interfaces such as key board, mouse and screen resolutions used to generate computerized nursing care plan in NIS were found to appropriate and easy to handle without much difficulty. The overall usability means score obtained by the subjects was 75.80 (56.99%) ± 5.75; hence it was evident that the developed NIS was highly usable for the nurses to develop a computer generated nursing care plan in a simplified and systematic method. The present study findings were supported by Schnall R et.al, 2012, that mean CSUQ factor scores obtained by the subjects were 2.13, 2.46 and 2.26 for system usefulness, information quality and interface quality respectively.

More than 95% of the subjects expressed moderate level of satisfaction towards the constructs of system usefulness, information quality and interface quality of NIS, whereas 91.7% subjects had moderate level of satisfaction about overall usability of the developed NIS. It might be the reason that nurses encountered the system for the first time to carry out the task which was different from the routine working pattern; also inadequate knowledge and experience with the system as well as the attitude of the nurses towards the nursing care plan lead to moderate level of satisfaction. The hospital should make a policy and implement to practice nursing care plan in the day today practice and to conduct regular in service and continuing education programs to improve the knowledge and skill in developing nursing care plans using the NIS. These statements were pertinent to the findings of Schnall R et.al who studied users (n=9) perception about the usability of a prototype Continuity of Care Record (CCR) with context-specific links to electronic HIV information resources and found that users were generally satisfied with the system, also findings of Michel-Verkerke (2011) showed that 93(47.7%) nurses accepted NIS for supplying unhampered access to complete, legible, structured patient data and agreed NIS was a good substitute for the paper record. Hosker (2007) also demonstrated that there was a link between negative attitudes towards computerized care planning and low level of perceived informatics competencies among trained nurses in the North of England. Many research findings were recommending the participatory approach to the introduction of information system which could be perceived to be beneficial for patient care and care providers.

Similar study findings by Lin HM (2006) evidenced that post implementation of hospital information system program, head nurses scored 4.99 on the knowledge of hospital information and operation of relevant intranet system and demonstrated 88% of satisfaction level indicating the importance of conducting nursing information training courses to effectively improve computer operation capacity, work efficiency, and satisfaction level. Other findings by Sequist TD, et.al, 2007, evidenced that 66% clinicians felt positive about EHR implementation process, one-third (35%) believed that the EHR improved overall quality of care, many (39%) felt that it decreased the quality of the patient-doctor interaction and one-third of clinicians (34%) reported that consistent use of electronic reminders improve quality and was strongly associated with increased utilization of the EHR (odds ratio 3.03, 95% confidence interval 1.05-8.8) whereas the majority (87%) of clinicians felt that information technology could potentially improve quality of care.

Correlation between the constructs of NIS

A significant positive correlation was found between system usefulness and information quality, interface quality of NIS at $p<0.01$($p=0.001$). Also, findings evidenced a significant positive correlation between overall usability and other constructs of NIS such as system usefulness ($p=0.000$), information quality ($p=0.000$), interface quality ($p=0.002$) at $p<0.01$. The findings were similar to the findings on factors influencing the acceptance of hospital information systems among nursing professionals in Taiwan indicated that system quality, information quality, and service quality were positively correlated with the perceived ease of use ($R=0.69$) and perceived usefulness ($R=0.72$); information quality has the greatest influence on perceived usefulness ($\gamma3=0.57$, P<0.001) and ease

of use (γ4=0.61, P<0.001) (Lu CH. 2012). Hence it was evident that nursing care requires high-quality healthcare information system to support the daily activities of nursing professionals.

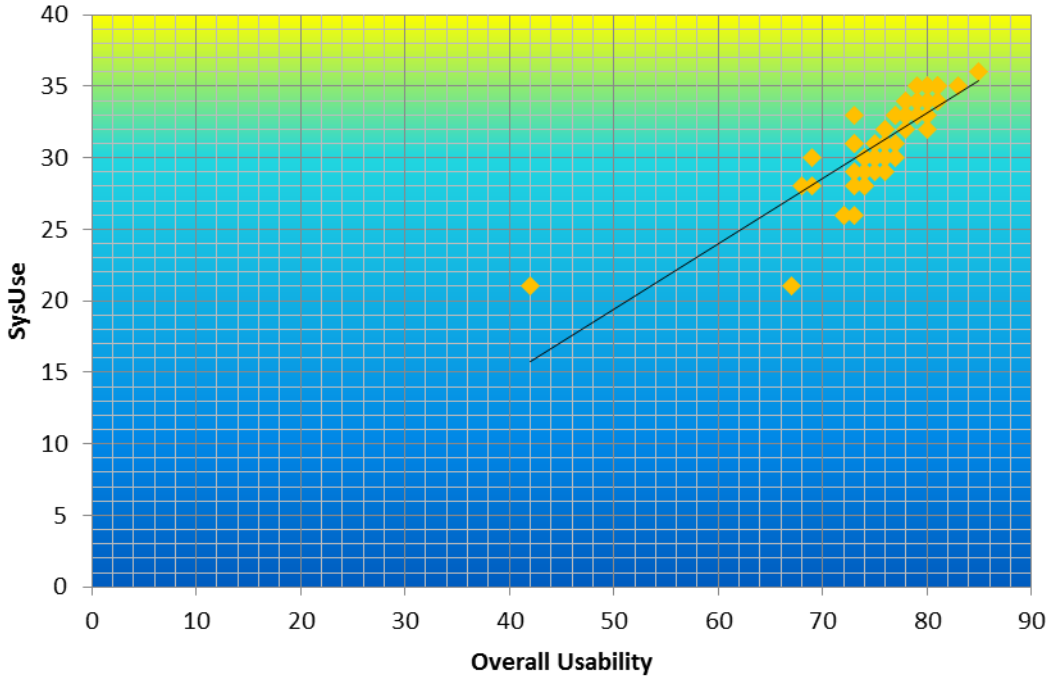

Fig 3: Positive correlation between overall usability and system usefulness

Association between constructs of Nursing Information System (NIS) and selected demographic characteristics of nurses

From the findings it was evident that there was no significant association found between system usefulness, information quality and overall usability of NIS and selected demographic characteristics of nurses at p<0.05. A similar research study found that there was inconsistency of the relationship between system usefulness and age of the subjects which was similar to the present study findings related to age (Mazzoleni MC, et.al, 1996).

The combined influence of demographic variables caused 13.8% variance (R^2=0.138, F=0.734, P>0.05) among nurses and the predictive ability of demographic variables is explained by β regression coefficient. From the above findings it was evident that demographic characteristics did not have any influence on system use. These findings were supported by Kapil Chalil Madathila et.al (2013), which indicated that total workload experienced by the hospital staff was significant (F (3,27) = 6.778, p = 0.018), whereas analysis of constructs of CSUQ showed that overall satisfaction F (3, 27) = 1.789, p = 0.237, System usefulness F (3, 27) = 3.826, p = 0.06, Interface quality F (3, 27) = 2.587, p = 0.136 and Information quality F (3,27) = 4.046, p = 0.058.

Results showed that gender (p=0.016) and professional qualification (p=0.002) had significant influence on interface quality of NIS at p<0.05 and overall influence of independent variables on interface quality was 36.2% (R-Square=0.362). The present study findings were supported by the study findings of Fai M (2009) which revealed that older age (β=0.13, P=0.01), higher educational levels (β=0.37, P<0.001) and experience in medical or specialist units significantly effect on nurses knowledge and skills in the clinical management system. Also, findings of Ting-Ting and Lee (2005) were consistent with the present study findings which revealed that level of education, previous experience in computer use and computer skills (P<0.05) had significant influence on nurses' attitudes towards computerized health information systems.

VII. CONCLUSIONS

The study findings evidenced that successful implementation and adoption of any new system was highly dependent on ease of system use, quality of information available with the developed system and also pleasantness of interfaces integrated with the system. The results of the present study clearly projected the ease of use and usability of the developed NIS and supports to implement in clinical setting.

Conflicts of Interest: Nil

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