CONTINUING EDUCATION

CE 1.5 ANCC CONTACT HOURS

The Omaha System as a Structured Instrument for Bridging Nursing Informatics With Public Health Nursing Education

A Feasibility Study

Debra L. Eardley, DNP, RN, APHN-BC, Kelly A. Krumwiede, PhD, MA, PHN, RN, Selda Secginli, PhD, Linda Garner, PhD, RN, APHN-BC, CHES, Conni DeBlieck, DNP, MSN, RN, Gulhan Cosansu, PhD, Nursen O. Nahcivan, PhD

Advancements in healthcare systems include adoption of health information technology to ensure healthcare quality. Educators are challenged to determine strategies to integrate health information technology into nursing curricula for building a nursing workforce competent with electronic health records, standardized terminology, evidence-based practice, and evaluation. Nursing informatics, a growing specialty field, comprises health information technology relative to the profession of nursing. It is essential to integrate nursing informatics across nursing curricula to effectively position competent graduates in technology-laden healthcare environments. Nurse scholars developed and evaluated a nursing informatics case study assignment used in undergraduate level public health nursing courses. The assignment included an unfolding scenario followed by electronic health record charting using standardized terminology to guide the nursing process. The assignment was delivered either online or in class. Seventy-two undergraduate students completed the assignment and a posttest. Fifty-one students completed a satisfaction survey. Results indicated that students who completed the assignment online demonstrated a higher level of content mastery than those who completed the assignment in class. Content mastery was based on posttest results, which evaluated students' electronic health record charting for the nursing assessment, evidence-based interventions, and evaluations. This innovative approach may be valuable to educators in response to the National Academy of Sciences recommendations for healthcare education reform.

Author Affiliations: Metropolitan State University, St Paul, MN (Dr Eardley); Minnesota State University, Mankato, MN (Dr Krumwiede); Florence Nightingale Nursing Faculty, Istanbul University, Turkey (Drs Secginli, Cosansu, and Nahcivan); Southeast Missouri State University, Cape Girardeau (Dr Garner); and New Mexico State University, Las Cruces (Dr DeBlieck).

The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

Corresponding author: Debra L. Eardley, DNP, RN, APHN-BC, College of Nursing & Health Sciences, Metropolitan State University, 700 E Seventh St, St Paul, MN 55106 (debra.eardley@metrostate.edu).

DOI: 10.1097/CIN.0000000000000425

KEY WORDS: Case study, Electronic health record, Nursing education, Nursing informatics, Standardized terminology

In recent years, healthcare systems have faced unprecedented changes with information management due to widespread adoption of health information technology (HIT): electronic health records (EHRs), standardized terminology, and evidence-based practice (EBP).[1–4] To address these technological advancements, nurse scholars have been working to build a nursing workforce competent with HIT to deliver high-quality healthcare.[3–6]

In 2001, a seminal publication by the Institute of Medicine (IOM) discussed the importance of healthcare reform and healthcare quality, provision of care that is safe, effective, efficient, timely, patient centered, and equitable.[1] In a follow-up study, the IOM called for educational reform, advising that healthcare professionals be competent in five key areas: patient-centered care, interdisciplinary teams, EBP, quality improvement, and informatics.[2] In response, the American Association of Colleges of Nursing (AACN) adopted the IOM recommendations.[5]

In 2008, AACN integrated the IOM recommendations into the *Essentials of Baccalaureate Education* and added a new Essential related to prevention and population health.[5] To address the revised Essentials, the Quad Council of Public Health Nursing Organizations published revised competencies to align with the 2001 IOM report.[7] Consequently, a rapidly growing HIT specialty field, nursing informatics (NI), central to the profession of nursing, has become an integral part of today's nursing education.[4,8–12]

Nursing informatics curricula approach HIT with the objective of teaching students about EHR, standardized terminology, and EBP.[4] Usually, NI is offered once in undergraduate and graduate programs, not including NI certification and degree programs. However, the current body of knowledge suggests integrating NI across nursing curricula to further

strengthen student competencies in HIT within the many fields of nursing practice, such as acute care, midwifery, and population health, including public health nursing (PHN).[4,8,9,11–13] A timely approach is required to address this training need; it is essential for building a competent nursing workforce ready to adopt HIT in all healthcare environments, but especially to effectively address prevention and population health. Filling this knowledge gap is critical, especially for the PHN workforce.

Nursing educators from the fields of PHN and NI explored innovative teaching strategies that weave HIT across nursing curricula, particularly in the PHN curriculum.[4,10,13,14] One effective teaching method used in nursing education is case studies. Case studies provide a platform for students to learn about and apply theoretical nursing concepts to real-world situations, which stimulate critical thinking in a safe learning environment.[4,13,15–19] The literature emphasizes the multiple benefits of using case studies that frame real-life situations for complex problem analysis in a systematic manner as part of nursing education.[20] While designing case studies is not unique in nursing education, there is limited knowledge about how to incorporate HIT into case studies to teach students EHR charting, standardized terminology, and EBP, as well as throughout nursing curricula.[3,4,11–13,19] Nurse scholars support the incorporation of HIT into case studies as a unique and innovative approach for building competencies with EHR charting and standardized terminology mapped to EBP as it relates to the nursing process.[3,4,8,9,13,19] In alignment with the advancements of HIT, and prevention and population health, there is a need for an effective approach for teaching HIT as it relates to PHN.

Nurse scholars assert that the integration of standardized terminology in education is a critical element and a prerequisite for teaching EHR charting, EBP, and outcomes reporting for quality improvement.[6,8,9,11,21] Standardized terminology not only makes evident what nurses do in practice, it also streamlines the nursing process for EHR charting, EBP, and data management.

Standardized terminologies are common classification systems that are embedded in the EHR for documentation and data management, for example to describe health problems, identify interventions, and develop a care plan, and may include an evaluation component.[3,4,6,11,19,22–25] There are 12 standardized terminologies recognized and endorsed by the American Nurses Association.[24] Examples include the Clinical Care Classification, used primarily in home healthcare; the North American Nursing Diagnosis Association–International, commonly used in acute care; and the Omaha System, primarily used for population health.[24] Of the 12 terminologies, the Omaha System provides a holistic framework, has been mapped to EBP, and includes an evaluation component.[4,13,19,22–25]

In population health, the Omaha System is the most widely used, and it is known for streamlining the nursing process, resulting in higher quality healthcare.[4,6,13,19,22–24] Used around the world in practice, education, and research, the Omaha System offers high utility, that is, a holistic framework, interface capability, interoperability, EBP, and an evaluation component.[4,6,19,22,23] In practice, the Omaha System is used interprofessionally. Although extensively researched for use in practice, additional research is needed to demonstrate the feasibility of the Omaha System as a structured instrument for education that reinforces critical thinking in practice.[4,13,14,19,25–28] As an innovative approach, nurse scholars designed a case study assignment that incorporated the use of HIT into an unfolding case scenario, and used the Omaha System to guide EHR charting and the PHN process of assessment, EBP, and evaluation.

The Omaha System framework is holistic and comprehensive and consists of three hierarchical components. The components are designed for a holistic assessment (Problem Classification Scheme), referred to as Problem/s; interventions (Intervention Scheme), referred to as Intervention/s; and an evaluation component (Problem Rating Scale for Outcomes), referred to as the KBS outcome rating scale.[4,19,26] In the Omaha System's holistic framework, the Problem Classification Scheme consists of four domains: (1) environmental, (2) psychosocial, (3) physiological, and (4) health-related behaviors. It comprises 42 Problem/s with a descriptive list of corresponding signs and symptoms. The Intervention Scheme describes the nursing intervention/s in a hierarchy of four levels.[19,26] The first level is the "Problem," followed by "categories" or nursing actions, "targets" or specific tasks associated with the categories, and "client-specific information" used to customize the intervention. There are four categories that describe the nursing action: (1) teaching, guidance, and counseling; (2) treatments and procedures; (3) case management; and (4) surveillance. Linked to the category is a target, which further specifies the foci of care. The client-specific information field, referred to as the care description field, allows the nurse to customize the intervention or care plan.[19,26] All four levels make up one intervention, and there are 12 600 possible combinations of problems, categories, and targets in the Omaha System.[19]

For example, when working with immigrant populations, it is standard practice for the PHN to complete a tuberculosis (TB) risk screening. In the case of a client with positive TB results, the EHR charting, guided by the Omaha System taxonomy, is as follows. Within the EHR, the PHN would select the problem "Communicable/infectious condition." Next, the PHN would identify corresponding signs/symptoms for "Communicable/infectious condition," which would be "infection" and "positive screening/culture/laboratory results." For the intervention, the PHN would select "surveillance," which would be linked to the action task of "screening procedures."[27,28]

The Problem Rating Scale for Outcomes evaluates the client's level of knowledge, behavior, and status related to the problem using a 5-point Likert-type ordinal scale (level 1 is lowest, and level 5 is highest). Commonly known as the KBS outcomes rating scale, it can be used at baseline, intermittently, and after the service event to gather meaningful data for outcomes evaluation.

For example, the PHN would evaluate the client's baseline knowledge of TB (eg, what does the client know about TB), behavior (eg, what the client is doing to address TB), and the status of his/her baseline signs/symptoms of active TB at the initial assessment. Collecting data for the client's knowledge, behavior, and status is essential to the measurement of outcomes. The Omaha System is widely recognized for its ability to provide an evaluation component as part of a service event.[19]

PURPOSE

To address the gap in the literature and respond to IOM's call for healthcare education reform, nurse scholars conducted a feasibility study to investigate the benefits of bridging NI with PHN education to teach EHR charting, EBP, and evaluation involving a case scenario of latent TB bacterial infection and directly observed therapy.

RESEARCH QUESTION

Is a PHN case study mapped to the Omaha System an effective instrument for teaching EHR charting, EBP, and evaluation involving a case scenario of latent TB bacterial infection and directly observed therapy?

METHODS

Sample and Design

This study used a descriptive case study design with a convenience sample of 72 nursing students enrolled in community/PHN courses during the spring term of 2015. All nursing students were undergraduates in three nursing schools in the Midwestern United States and in Istanbul, Turkey. In November 2014, an invitation was extended to nurse educators (nationally and internationally) to participate in this collaborative multisite study. The electronic invitation was sent on two e-mail discussion lists, the Omaha System network and the Association of Community Health Nurse Educators. The electronic invitation sought to recruit nurse educators interested in using and/or learning about the Omaha System as a structured instrument for PHN education. Thus, a partnership was formed with four nursing schools who agreed to pilot the NI case study assignment in undergraduate nursing programs. Nurse educator participation was voluntary, regardless of expertise and level of experience with the Omaha System.

Nursing students were introduced to the case study assignment in either a classroom or an online learning environment. The emphasis for this study was not to compare learning outcomes between different delivery methods, but to evaluate the effectiveness of the Omaha System standardized terminology as an instrument for teaching EHR charting and the nursing process in PHN education. Students were assured of anonymity and that the decision of whether to participate would not affect course grades. Educators explained that the case study assignment would take approximately 30 to 60 minutes to complete. Students were 18 years or older and had not been formally introduced to the Omaha System in class before the case study assignment. Participants had to complete the posttest to be entered into the analyses. Basic demographic characteristics included location and university, sex, and educational level (Table 1).

The university's institutional review board approved this study. Each participant gave informed consent, and identity was kept confidential. In 2013, two nurse scholars (with expertise in NI and PHN) developed an NI case study assignment involving latent TB bacterial infection and directly observed therapy.[27,28] The latent TB bacterial infection case scenario was selected because it is an important and current public health problem both in the United States and Turkey.[29]

NURSING INFORMATICS CASE STUDY ASSIGNMENT

The NI case study assignment was designed at the novice level and consisted of four components. The first two components

Table 1. Student Characteristics

University	Location of university	All (N = 72), n (%)	Min-Max Age, y	Sex (Female/Male), %	Educational Level	Type of Course Teaching	Semester Teaching Course
State	Western (Turkey)	17 (24)	20–22	100/0	BSN	PHN	4
State	Midwestern (United States)	21 (29)	27–61	94/6	BSN	PHN	4
State	Midwestern (United States)	16 (22)	18–27	92/8	BSN	PHN	4
State	Midwestern (United States)	18 (25)	18–45	81/19	BSN	PHN	4

Abbreviation: PHN, public health nursing.

included narrated slide show tutorials. The last two components included a posttest and a satisfaction survey. The first tutorial, NI PHN case study part 1, consisted of 10 slides containing ground level information about the EHR and standardized terminology, the Omaha System, used for a holistic assessment, EBP, and evaluation.[3,4,19,26] In addition, part 1 included a graphic demonstrating how the Omaha System, streamlined the nursing process, and a concept map of the Omaha System framework.[27] The second tutorial, NI PHN case study part 2, included a description of the role of the PHN working with a communicable/infectious disease (latent TB bacterial infection) and directly observed therapy definitions. This was followed by a case scenario, designed by the first author, of a female adult known as Hermina, who faced a new diagnosis of latent TB bacterial infection with apprehension. The case scenario focused on the PHN role working with a client newly diagnosed with a communicable disease and requiring directly observed therapy. The scenario was guided by the work of PHN consultants from the Minnesota Department of Health Disease Prevention & Control group,[27,28] and it was evaluated by an expert panel to ensure the reliability of Omaha System components.[27] The expert panel members included four nurse scholars with expertise in the Omaha System, PHN, and NI.

After the contents of the case scenario were explained, participants were provided a clinical summary to help them complete Omaha System charting within the EHR for the assessment, EBP, and evaluation.[19,26] The case study concluded with a sample of screenshots of a widely used EHR (Nightingale Notes; Champ Software, Mankato, MN) that embeds the Omaha System to further demonstrate the PHN process and an autogenerated service/care plan. Assignment data for the case study were collected online and in a classroom environment using paper and pencil. The case study tutorials were translated from the original English version into Turkish by the Turkish authors.[29]

DATA COLLECTION TOOL

A self-administered posttest and a satisfaction survey were used to evaluate content mastery and participant satisfaction. The posttest (two sections) and satisfaction survey were developed by the first author based on a review of the literature[14,19,26] and were reviewed by the other authors.

The first section of the posttest was based on Omaha System components: the Problem Classification Scheme, the Intervention Scheme, and the Problem Rating Scale for Outcomes. The Problem Classification Scheme is the assessment component, and it provides structure and terms for a standardized assessment of individuals, families, and communities. As previously discussed, the Problem Classification Scheme consists of four domains and 42 client problems or areas of concern. The Intervention Scheme is the component used to describe health-related care plans and services for individuals, families, and communities. The scheme is a taxonomy of nursing interventions and consists of four categories: teaching, guidance, and counseling; treatments and procedures; case management; and surveillance.[25] The Problem Rating Scale for Outcomes is an evaluation component to measure client progress throughout a service event. It consists of three 5-point Likert-type scales to measure the entire range of severity for the concepts of knowledge, behavior, and status. Levels of knowledge range from level 1, no knowledge, to level 5, superior knowledge. Levels of behavior range from level 1, not appropriate, to level 5, consistently appropriate. Levels of status range from level 1, extreme signs/symptoms, to level 5, no signs/symptoms.

The posttest included seven multiple-choice questions for which participants needed to correctly identify elements of the PHN process within the EHR using Omaha System components. The Problem Classification Scheme posttest questions focused on the communicable/infectious condition and the medication regimen, with a corresponding checklist of signs and symptoms for each of these two problems. The posttest questions for the Intervention Scheme, which were mapped to evidence-based guidelines, included surveillance, and teaching, guidance, and counseling. Finally, the Problem Rating Scale for Outcomes focused on baseline levels of KBS regarding the new diagnosis of latent TB bacterial infection and directly observed therapy.

The satisfaction survey comprised four items that assessed participant satisfaction with the case study assignment. One item asked about the overall measure of satisfaction, with five response options ranging from 1 (very dissatisfied) to 5 (very satisfied). Three open-ended satisfaction questions asked what participants liked most about the case study, what they liked least, and what recommendations they had for future application.

To ensure that the translation from the English to Turkish version could be understood, the case study assignment was pilot-tested with eight Turkish participants using paper and pencil in the classroom.[29] This trial determined that students could easily complete the case study assignment and they did not request any clarification.

DATA COLLECTION TOOL

The case study assignment was presented online at three schools and in class at the fourth school. Participants completed the assignment either independently or as a group. Participants who completed the case study in class, as a group, received the posttest in pencil-and-paper format immediately after completion of the case study assignment. The remaining participants uploaded their posttest via an online assignment folder. After participants completed the posttest and satisfaction survey, the correct posttest answers were provided.

DATA ANALYSES

Data were analyzed using IBM SPSS Statistics v.16 (IBM, Armonk, NY) and Microsoft Excel (Microsoft, Redmond, WA). Descriptive statistics were used to analyze posttest results pertaining to the Omaha System Problems, including signs/symptoms, Interventions, and Problem Rating Scale for Outcomes (baseline evaluation) and one item of the satisfaction survey responses. The analysis was conducted on the entire sample and for two subgroups categorized by the data collection process (online and classroom). The differences in the answers of the two subgroups were tested for significance using χ^2 test for the Omaha System variables. Statistical significance was determined by a $P < .05$.

For the qualitative analysis, the authors worked independently to code, categorize, and identify themes in the narrative comments from the open-ended questions. These themes were reviewed for similarities and differences in classifying the data. Agreement on final categorizations was achieved through discussion and consensus among the authors.

RESULTS

The total of 72 participants were divided between the online group, 70.8% (n = 51), and the classroom group, 29.2% (n = 21). The posttest results are reported using the Omaha System components, Problem Classification Scheme (assessment), Intervention Scheme (EBP), and Problem Rating Scale for Outcomes (evaluation).

Omaha System Problems

The first two questions pertained to the Omaha System Problem Classification Scheme and corresponding signs and symptoms. Participants were asked to select all of the "signs/symptoms" applicable to the patient, Hermina, which focused on the Omaha System Problem "communicable/infectious condition," and 75% (n = 54) correctly assessed the infection as the sign/symptom of the problem. In the online group, 80.4% (n = 41) answered correctly; in the classroom group, 61.9% (n = 13) provided the correct answer. However, this difference between the two groups was not significant ($\chi^2 = 2.711$, $P = .10$).

In addition, 95.8% of all the participants (n = 69), 100% of the online group (n = 51), and 85.7% of the classroom group (n = 18) correctly assessed positive screening/culture/laboratory results as signs and symptoms experienced by Hermina. A greater proportion of the online group (100%) correctly assessed the Problem's signs/symptoms as compared to the classroom group (85.7%) (Fisher's $P = .022$) (Figure 1).

The second question pertained to the Omaha System Problem "medication regimen." Participants were asked to select all of the applicable "signs/symptoms" for Hermina in relation to her medication regimen; only 33.3% of all participants (n = 24) selected "other—is adverse to taking medications, e.g. pills." A greater proportion of the online group (43.1%) gave the correct assessment, compared with 9.5% of the classroom group ($\chi^2 = 7.563$, $P = .006$) (Figure 1).

Omaha System Interventions

Two questions addressed the Intervention component. As part of the case scenario, participants were provided contextual information about the interventions (at the first visit, the PHN reviewed the new diagnosis of latent TB bacterial infection and the medication regimen with Hermina and weighed her). Participants were asked to identify the Omaha System Intervention that reflected EBP (ie, Centers for Disease Control and Prevention latent TB bacterial infection guidelines) as it related to the case scenario; of the total sample, 87.5% (n = 63) correctly identified "surveillance—signs/symptoms physical: evidence of disease/infection" and

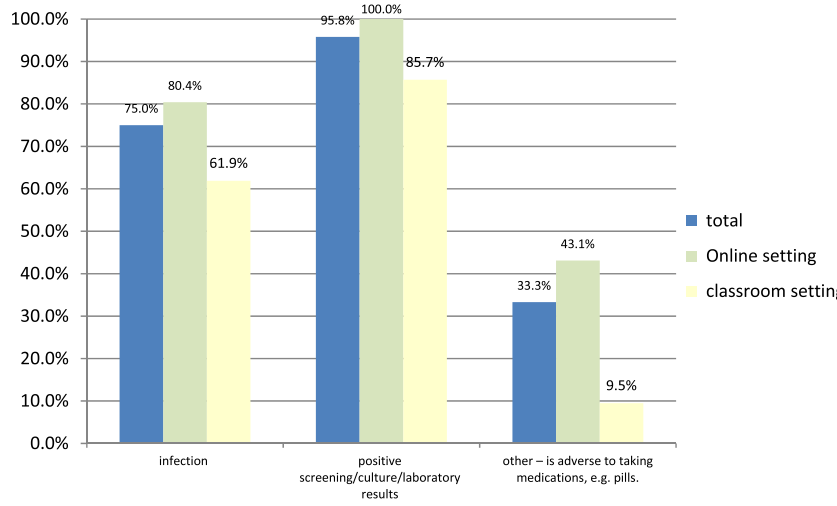

FIGURE 1. Content mastery of Omaha System Problem: (1) communicable/infectious condition and (2) medication regimen.

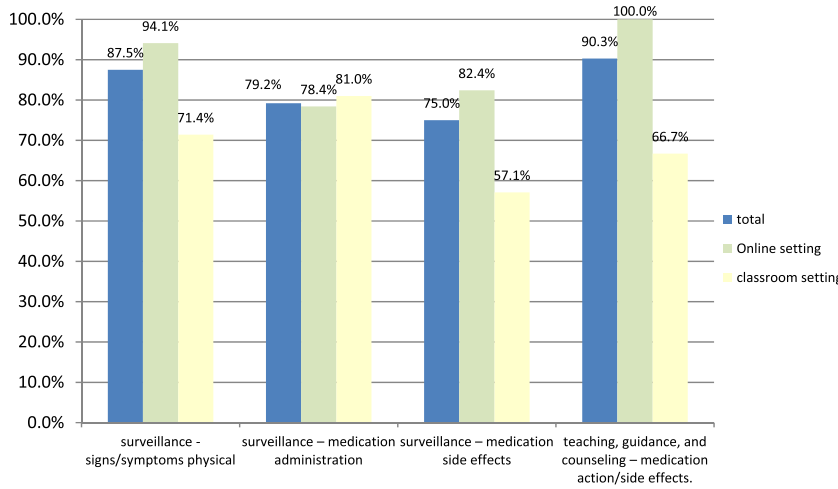

FIGURE 2. Content mastery of Omaha System Interventions for directly observed therapy.

"monitor weight." A greater proportion of the online group (94.1%) correctly identified appropriate interventions and targets than the classroom group (71.4%) (Fisher's P = .015) (Figure 2).

The second question highlighted the role of the PHN, who enrolled Hermina in directly observed therapy and provided education about monitoring potential side effects of the drug therapy. The question asked participants to identify the Omaha System Interventions that reflected EBP in this context. Of the 72 participants, 79.2% (n = 57) correctly identified the appropriate intervention and target of "surveillance—medication administration." In the online group, 78.4% (n = 40) answered correctly, as did 81% of the classroom group (n = 17) (Fisher's P = 1.000). However, this difference was not significant (P > .05).

Seventy-five percent of the participants (n = 54) correctly identified the appropriate intervention of "surveillance—medication side effects." A greater proportion of the online group (82.4%) correctly identified the appropriate intervention and target than the classroom group (57.1%) (χ^2 = 5.042, P = .025). In addition, 90.3% of the participants (n = 65) correctly identified the appropriate intervention of "teaching, guidance, and counseling—medication action/side effects." A greater proportion of the online group (100%) provided the correct answer than the classroom group (66.7%) (Fisher's P < .05) (Figure 2).

Omaha System Outcomes

Three of the posttest questions pertained to the Problem Rating Scale for Outcomes component. The first of the three questions focused on the Omaha System Problem Rating Scale for Outcomes "knowledge." When asked to evaluate Hermina's initial level of knowledge regarding LTBI and treatment, only 38.9% of all participants (n = 28) selected the most appropriate answer of "no knowledge of disease and treatment (Rx)." A greater proportion of the online group (54.9%) correctly evaluated the knowledge outcomes than the classroom group (0%) (P < .05) (Figure 3).

For the second question, participants were asked to use the Omaha System Problem Rating Scale for Outcomes "behavior" to evaluate the behavior of Hermina related to latent TB bacterial infection treatment and directly observed

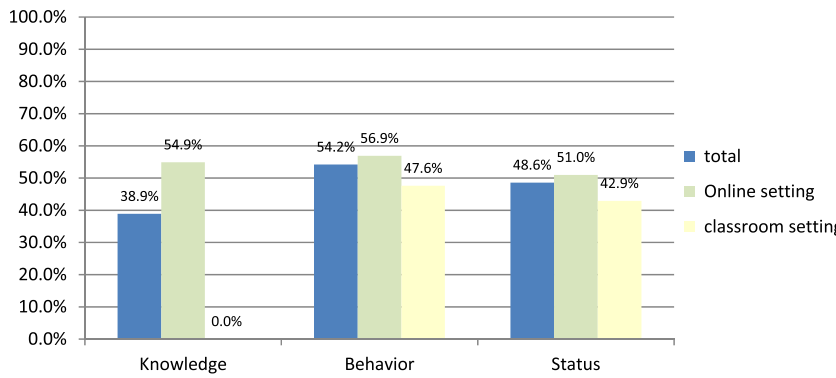

FIGURE 3. Content mastery of Omaha System baseline evaluation.

therapy; only 54.2% of all participants (n = 39) selected "usually appropriate behavior," and 57% of the online group and 48% of the classroom group selected the correct evaluation. However, this difference was not significant ($\chi^2 = 0.512$, $P = .474$) (Figure 3).

The last question focused on the Omaha System Problem Rating Scale for Outcomes "status." When asked to describe Hermina's current status in terms of directly observed therapy adherence, only 48.6% of all participants (n = 35) selected the most appropriate answer of "minimal signs/symptoms—Rx side effects are not present, or seldom occur/improving lab results." In addition, 51% of the online group and 43% of the classroom group correctly evaluated Hermina's status in this context. However, this difference was not significant ($\chi^2 = 0.393$, $P = .531$) (Figure 3).

Satisfaction Survey

Overall, 100% of the participants (n = 72) completed the posttest, and 71% (n = 51) completed the satisfaction survey that included three open-ended questions about the case study assignment. Of a maximum Likert score of 5, the mean (SD) satisfaction (n = 51) with the latent TB bacterial infection case study was 3.88 (0.68). Most participants (69.9%, n = 38) reported that they were satisfied or were very satisfied with the case study. Themes evident in the narratives about what participants liked most about the case study included the following: (1) "easy to use, short and informative," supported by quotes such as "description and clearance was impressive, easy to identify epidemiological triad, and easy to comprehend terminology"; (2) "knowledge gained about the Omaha System," supported by quotes such as "case study is a good example in helping understand the basics about the Omaha System in screening and follow-up"; and (3) "real-world global health problem," supported by quotes such as "the information was presented as a scenario similar to what we may find in practice."

While participants had many positive comments about the case study, they also provided comments about what they liked least about the case study. The following themes were evident: (1) "decision-making challenge," supported by quotes such as "it is difficult to make decisions and wanted additional information"; (2) "ambiguity," supported by quotes such as "some details weren't clear and if they had been clearer the case would have felt more real and I would have created a better case solution"; and "lack of finality with Hermina and directly observed therapy," supported by quotes such as "it didn't discuss what results were found at the follow-up appointment. It would have been nice to know if her labs were improving."

Participants recommended ways to improve the case study. Themes that were evident in the narratives included (1) "desire an interactive module," supported by quotes such as "making the case scenario more interactive"; and (2) "decrease ambiguity," supported by quotes such as "perhaps refine the intervention section to make it more explicit" and "more information regarding Hermina's final lab results would have been helpful."

DISCUSSION

The purpose of this feasibility study was to investigate whether the use of an NI case study assignment mapped to the Omaha System would enhance student skills and competency in EHR charting for the PHN process of assessment, EBP, and evaluation. Overall, the results demonstrated that students met the learning objectives and skill development with EHR charting for the nursing process using a holistic standardized terminology, the Omaha System. This innovative teaching strategy addressed the call from the literature to weave HIT across nursing curricula.[4,10,13,14] For the purpose of this feasibility study, the authors focused on PHN curricula. This innovative approach, designed for nursing education, warrants further study as an exemplar for blending NI with PHN in nursing education and practice.

Although all posttest results were not statistically significant, the differences between the online group and the classroom group were identified with respect to the two Omaha System Problems and corresponding signs/symptoms; most participants in the online group identified appropriate Omaha System Problems and the corresponding signs/symptoms as compared to the classroom group. Similarly, a greater proportion of students in the online group correctly identified the appropriate interventions, categories, and targets as compared to the classroom group.

In this study, the students in the classroom setting generally had lower scores in all Omaha System components than students in the online setting, although not all differences were statistically significant. There may have been instructional variables (eg, teaching styles, technical skills, and varying levels of expertise with the EHR and the Omaha System) that may have influenced posttest results among groups. It is crucial that students learn how to collect and analyze outcomes data for quality improvement.[4,6,19] The challenges both groups experienced in terms of the Omaha System Problem Rating Scale for Outcomes are consistent with challenges experienced by PHNs in practice.[16] Since the Problem Rating Scale for Outcomes was difficult for participants to master in the case study assignment, future edits will include additional instructional materials for how to effectively use the evaluation scale for data collection and analysis of a client's level of knowledge, behavior, and status, at baseline, midterm, and post service event.[4] Thus, the Problem Rating Scale for Outcomes is a robust tool for evaluation of outcomes.

LIMITATIONS

Limitations to this study included the lack of a control group, small purposive sample size, and posttest-only design. Three

institutions used online data collection methods, and one institution used a paper-and-pen version. Satisfaction data were collected in three of the four institutions. Among the four universities, educators possess varying levels of expertise with NI and, in particular, the Omaha System. However, the case study assignment was developed for educators with minimal knowledge of NI, specifically EHR charting using the Omaha System.

RECOMMENDATIONS

The NI case study assignment is a blended approach for NI and PHN, which needs further examination. It is recommended that the case study assignment be replicated and incorporate use of an experimental design to validate findings. Although most participants were satisfied with the case study assignment, future research should include efforts to enhance the case study platform. For example, participants requested a more interactive case study. The process for administration of the posttest should be standardized. The NI case study assignment should be considered as an innovative approach for teaching HIT, including EHR charting, EBP, and evaluation, in relation to other nursing specialty fields such as acute care, geriatrics, and pediatrics, and perhaps used in the clinical environment for employee training purposes.

CONCLUSION

Nurse scholars developed a case study assignment that provides nurse educators with a platform to integrate NI with nursing education and the opportunity to incorporate theoretical knowledge and apply critical reasoning, judgment skills, and problem solving in a safe learning environment. Thus, students are able to gain in-depth knowledge for disease prevention and management with an instructional approach that enhances learning outcomes through use of real-world scenarios and situated e-learning. The study results demonstrated that a case study mapped to the Omaha System is an effective instrument for teaching EHR charting and the PHN process for population health. This innovative approach may be valuable to nurse educators in response to the IOM' recommendations for healthcare education reform.

A serendipitous discovery was the successful collaboration of multiple researchers across international and national borders with the use of virtual environments. This experience has provided a wider perspective of the benefits of collaborative research in developing methods to blend NI with PHN education. Nurse educators should consider using the NI case study assignment as a teaching pedagogy to enhance nursing students' skills and competency in HIT and the PHN process of assessment, EBP, and outcomes evaluation.

This feasibility study involves original work of the "Partnership for Informatics in Nursing Education" (PINE). The PINE has provided an open-source library with additional NI case study assignments. The library is under expansion for the provision of a variety of case study scenarios available to educators. To learn more, go to http://omahasystemmn.org/data.php.

Acknowledgments

The authors thank Dr Karen Monsen for her content review of the Omaha System, Champ Software for providing screenshots, and the students who consented to sharing their de-identified study results.

References

1. Institute of Medicine. Crossing the quality chasm. A new health system for the 21st century. The Health and Medicine Division (HMD) of the National Academies of Sciences, Engineering, and Medicine. http://www.nationalacademies.org/hmd/Reports/2001/Crossing-the-Quality-Chasm-A-New-Health-System-for-the-21st-Century.aspx. Accessed August 15, 2013.
2. Institute of Medicine. Health professions education: a bridge to quality. The National Center for Biotechnology Information. https://www.ncbi.nlm.nih.gov/books/NBK221528/. Accessed December 1, 2015.
3. Monsen KA, Foster DL, Gomez T, et al. Evidence-based standardized care plans for use internationally to improve home care practice and population health. *Applied Clinical Informatics*. 2011;2(3): 373–383.
4. Nelson R, Staggers N. *Health Informatics: An Interprofessional Approach*. Reprinted 2nd ed. St Louis, MO: Mosby; 2018.
5. American Association of Colleges of Nursing. The essentials of baccalaureate education for professional nursing practice. http://www.aacn.nche.edu/education-resources/BaccEssentials08.pdf. Accessed August 15, 2013.
6. Monsen KA, Schenk E, Schleyer R, et al. Applicability of the Omaha System in acute care nursing for information interoperability in the era of accountable care. *American Journal of Managed Care*. 2015;3(3): 53–61.
7. Association of Community Health Nursing Educators (ACHNE). Quad Council Coalition of Public Health Nursing Organizations (QCC) Quad Council competencies for public health nurses. http://www.achne.org/files/Quad%20Council/QuadCouncilCompetenciesforPublicHealthNurses.pdf. Accessed August 15, 2013.
8. Dolansky MA, Moore SM. Quality and Safety Education for Nurses (QSEN): the key is systems thinking. *Online Journal of Issues in Nursing*. 2013;18(3): 1.
9. The Technology Informatics Guiding Education Reform [TIGER]. Evidence and informatics transforming nursing: 3-year action steps toward a 10-year vision. The American Association of Colleges of Nursing (AACN). http://www.aacn.nche.edu/education-resources/TIGER.pdf. Accessed December 1, 2015.
10. Hickey MT, Forbes M, Greenfield S. Integrating the Institute of Medicine competencies in a baccalaureate curricular revision: process and strategies. *Journal of Professional Nursing*. 2010;26(4): 214–222.
11. Alliance for Nursing Informatics. Alliance for nursing informatics position to the ONC federal information technology strategic plan 2011–2015. http://www.allianceni.org/documents/ANIPositionONCFederalITStrategicPlan.pdf. Accessed June 15, 2016.
12. Canadian Association of Schools of Nursing. Nursing informatics teaching toolkit: supporting the integration of the CASN nursing informatics competencies into nursing curricula. Canadian Association of Schools of Nursing. http://casn.ca/wp-content/uploads/2014/12/2013ENNursingInformaticsTeachingToolkit.pdf. Accessed June 15, 2016.
13. Garcia C, Schaffer M, Schoon P. *Population-based public health clinical manual: the Henry Street Model for nurses*. 2nd ed. Indianapolis, IN: Sigma Theta Tau International; 2014.
14. Radhakrishnan K, Martin KS, Johnson KE, et al. Effective teaching-learning strategies for the Omaha System. *Home Healthcare Now*. 2016;34(2): 86–92.
15. Arbour MW, Nypaver CF, Wika JC. Innovative uses of technology in online midwifery education. *Journal of Midwifery and Women's Health*. 2015;60: 278–282.

16. DeSanto-Madeya S. Using case studies based on a nursing conceptual model to teach medical-surgical nursing. *Nursing Science Quarterly*. 2007; 20(4): 324–329.
17. Forsgren S, Christensen T, Hedemalm A. Evaluation of the case method in nursing education. *Nurse Education in Practice*. 2014;14(2): 164–169.
18. Sprang SM. Making the case: using case studies for staff development. *Journal for Nurses in Staff Development*. 2010;26(2): E6–E10.
19. Martin KS. *The Omaha System: a key to practice, documentation, and information management*. Reprinted 2nd ed. Omaha, NE: Health Connections Press; 2005.
20. Bimray PB, Le Roux LZ, Fakude LP. Innovative education strategies implemented for large numbers of undergraduate nursing students: the case of one South African University nursing department. *Journal of Nursing Education and Practice*. 2013;3(11): 116–120.
21. The Technology Informatics Guiding Educational Reform (TIGER). Informatics competencies collaborative final report. International Medical Informatics Association. http://tigercompetencies.pbworks.com/f/TICC_Final.pdf. Accessed June 15, 2016.
22. Erdogan S, Secginli S, Cosansu G, et al. Using the Omaha System to describe health problems, interventions, and outcomes in home care in Istanbul, Turkey: a student informatics research experience. *Computers, Informatics, Nursing*. 2013;31(6):290–298.
23. Topaz M, Radhakrishnan K, Masterson R, et al. Putting evidence to work: using standardized terminologies to incorporate clinical practice guidelines within homecare electronic health records. *Online Journal of Nursing Informatics*. 2012;16(2). http://ojni.org/issues/?p=1694. Accessed August 15, 2013.
24. Lundberg C, Warren J, Brokel J, et al. Selecting a standardized terminology for the electronic health record that reveals the impact of nursing on patient care. *Online Journal of Nursing Informatics*. 2008;12(2). https://ojni.org/12_2/lundberg.pdf. Accessed August 15, 2013.
25. Topaz M, Golfenshtein N, Bowles KH. The Omaha System: a systematic review of the recent literature. *Journal of the American Medical Informatics Association*. 2014;21(1): 163–170.
26. The Omaha System. Solving the clinical data-information puzzle. Omaha System overview. http://www.omahasystem.org/overview.html. Accessed August 15, 2013.
27. The Omaha System Community of Practice. Omaha System care plans and practice tools latent tuberculosis infection—local/state public health. The Omaha System community of practice. http://omahasystemmn.org/Careplans/communicable/tuberculosis/State%20group%20interventions%20LTBI%20Pathway%20with%20resources%203%204%2013.pdf. Accessed August 15, 2013.
28. Minnesota Department of Health Disease Prevention & Control, Omaha System User's Group. 2013. Latent tuberculosis infection—local/state public health. http://omahasystemmn.org/Careplans/communicable/tuberculosis/State%20group%20interventions%20LTBI%20Pathway%20with%20resources%203%204%2013.pdf. Accessed August 15, 2013.
29. Erdogan S, Esin NM. The Turkish version of the Omaha System: its use in practice-based family nursing education. *Nurse Education Today*. 2006; 26(5): 396–402.

For more than 29 additional continuing education articles related to educational strategies, go to NursingCenter.com/CE.

Instructions for Taking the CE Test Online
The Omaha System as a Structured Instrument for Bridging Nursing Informatics With Public Health Nursing Education: A Feasibility Study

- Read the article. The test for this CE activity can be taken online at www.nursingcenter.com/ce/CIN. Tests can no longer be mailed or faxed.
- You will need to create a free login to your personal CE Planner account before taking online tests. Your planner will keep track of all your Lippincott Professional Development online CE activities for you.
- There is only one correct answer for each question. A passing score for this test is 12 correct answers. If you pass, you can print your certificate of earned contact hours and the answer key. If you fail, you have the option of taking the test again at no additional cost.
- For questions, contact Lippincott Professional Development: 1-800-787-8985.

Registration Deadline: June 5, 2020

Disclosure Statement:

The authors and planners have disclosed that they have no financial relationships related to this article.

Provider Accreditation:

Lippincott Professional Development will award 1.5 contact hours for this continuing nursing education activity.

Lippincott Professional Development is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia Board of Nursing, #50-1223, Florida Board of Nursing, #50-1223, and Georgia Board of Nursing, #50-1223.

Payment:

- The registration fee for this test is $17.95