A Data-driven Approach for Evaluating Integrative Health Intervention Utilization and Outcomes in Community-based Care

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Dedication

For my wife Ying-Hsien and parents

Abstract

Integrative health (IH) interventions are increasingly used in conventional healthcare in a variety of settings. Approaches are needed to capture and evaluate the effectiveness of IH interventions in real-world settings. A literature review suggested that use of standardized terminologies has potential to facilitate structured IH intervention data collection for meaningful use. An examination of the Omaha System found that the Omaha System is broadly applicable to represent IH interventions and can operationalize the interventions within existing clinical datasets, such as electronic health records, for intervention evaluations. Forty-six Omaha System target terms were found to be applicable to represent IH interventions. Use of the target terms to operationalize IH interventions in an existing clinical dataset generated in community-based care enabled an in-depth data-driven analysis to examine IH intervention use. This provided novel insights into nursing IH practice. The analysis revealed that IH interventions accounted for a substantial number of interventions in community-based care and were associated with better outcomes for clients. Differing patterns of IH interventions delivered to different populations were revealed and supported the notion of intervention tailoring. This research presents an exemplar for a data-driven approach evaluating IH intervention use and outcomes using existing clinical datasets. Further research is needed to validate these findings and expand the approach to explore IH intervention use and outcomes for other populations across healthcare settings.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

The healthcare system of the United States needs to improve its accessibility, quality, safety, and affordability, as demands for symptom management and preventive services increase (Institute of Medicine (US) Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, 2011). Adopting integrative health (IH) interventions is an important strategy to improve health and the healthcare system (Koithan, 2015). Nurses have used IH interventions, such as massage, music therapy, and meditation, for centuries and are leaders in maximizing the use of IH interventions as part of a comprehensive, holistic approach to health (Cutshall & Pestka, 2018; Kreitzer, 2015). Scientific efforts have been made to investigate the current use of IH interventions in nursing practice (Hall et al., 2017; Shorofi & Arbon, 2017). Approximately 54% of nurses reported that they had provided IH interventions to patients, according to the authors of a systematic review (H.-Y. Chang & Chang, 2015). Numerous nursing IH interventions have been evaluated and found to be effective in managing a variety of symptoms, including pain, anxiety, insomnia, depression, and constipation (Johnson et al., 2016; Meghani et al., 2017a, 2017b). However, little is known about nursing IH interventions in terms of type, amount, and purpose in real-world practices. Furthermore, previous investigations focused on acute care settings or institution-based settings. The use and outcomes of IH interventions in community-based care are unknown. Approaches are needed to capture and evaluate the effectiveness of IH interventions in real-world settings, including community-based care.

The adoption of electronic health records (EHRs) and standardized terminologies

creates new opportunities for IH intervention use and outcome evaluation. Use of standardized terminologies is a promising method to facilitate structured clinical data collection for program evaluation and knowledge discovery (Martin et al., 2011; Monsen et al., 2018; Monsen, Brandt, et al., 2017). It may be feasible to apply existing big data methods in the IH context (Lu et al., 2020). Methods are needed to enable structured IH intervention data collection using standardized terminologies to leverage clinical data to support nursing IH intervention delivery and research (Austin, 2018; National Center for Complementary and Integrative Health [NCCIH], 2016; Zayas-Cabán et al., 2020).

Background

Integrative health

Integrative health enhances the health and well-being of individuals, families, and communities via a diversity of evidence-based strategies, including both biomedical and complementary approaches, from a relationship-based, person-centered, and holistic perspective (Koithan, 2018; Snyder & Lindquist, 2018). In this research, IH interventions were interventions that align with the definition of IH and can be used as stand-alone interventions or in combination with biomedical therapies. Evidence supports the use of IH interventions to alleviate a variety of conditions, including pain, heart diseases, mental illness, and sleeping disorder (Cramer et al., 2013; Q. Gu et al., 2017; Meghani et al., 2017a, 2017b). Numerous IH interventions are used in several conventional healthcare settings in the U.S. and around the world (Cutshall & Pestka, 2018; Smeeding et al., 2010; Taylor et al., 2019). With the increasing use of IH interventions, there is a need to understand what, why, and how many IH interventions are delivered and what outcomes of IH interventions are in real-world practices.

Community-based care

Integrative health interventions can play a significant role in community-based care since they share the same goal. The shared goal is to enhance clients' health and well-being through using holistic and whole-person approaches to cure diseases, manage symptoms and prevent future illness (Cutshall & Pestka, 2018; Koithan et al., 2018; Monsen, Farri, et al., 2011). Literature indicated that several community-based healthcare agencies had developed their programs to include IH approaches for promoting human health and well-being (Cutshall & Pestka, 2018). Although numerous investigations were done to understand the use of IH interventions in nursing practice (H.-Y. Chang & Chang, 2015; Kamizato et al., 2013; Metin et al., 2018), none of the research focused on community-based care. There is a gap in knowledge about IH intervention utilization and outcomes in community-based care.

Health information technology

Health Information technology (HIT) creates new opportunities for exploring IH intervention use and outcomes in a real-world setting. Specifically, EHRs have capability to offer data needed to conduct the exploration using a data-driven approach (Brennan & Bakken, 2015; Gao et al., 2019; Monsen, Brandt, et al., 2017). A robust way to collect IH intervention data in a structured form at the point of care in EHRs is lacking. Standardized terminologies, collections of vocabulary and phrases for clinical practice representation and communication, are promising tools to facilitate structured clinical data collection at the point of care (Coenen et al., 2001; Martin et al., 2011; Rosenbloom et al., 2006). The Omaha System, a widely used standardized terminology in community-based care, has potential to facilitate collection and capture of IH intervention data in

EHRs for intervention evaluations and knowledge discovery (Kessler et al., 2020; Martin, 2005). The Omaha System has been shown to represent a variety of IH interventions managing conditions, including pain, fatigue, intestinal problems, mental illness, cognitive impairment, and sleeping disorders (Kessler et al., 2020).

The purpose of this research was to develop a data-driven approach for evaluating IH intervention use and outcomes for clients receiving community-based care using standardized clinical data. To achieve the goal, this research had three specific aims: 1) to operationalize IH interventions using standardized terminology based on previous work and evidence.; 2) to describe and compare the use of IH interventions delivered in community-based care; and 3) to evaluate the extent to which IH interventions predict client outcomes, after controlling for demographics, baseline assessments, and service characteristics.

Theoretical Framework

The Problem-Intervention-Outcome Meta-Model (PIO MM) was used as a theoretical framework guiding this data-driven study. The PIO MM describes the relationships between changes of a problem of the population of interest over time, interventions and interventionists, and setting (Monsen, 2018). The model was developed to provide a theoretical foundation for projects examining intervention outcomes for particular populations within given settings (Monsen, 2018). The model informed overall design, provided guidance on variable choice, and offered a theoretical foundation to support the findings of this research. Additionally, the Omaha System was used to operationalize key variables (problems, interventions, and outcomes) and relate these variables in data to enable the evaluation of IH intervention use and outcomes (Martin,

2005; Monsen et al., 2018).

Construction of the Dissertation

This research comprises five chapters to present a data-driven approach leveraging a standardized terminology and EHR data to support IH intervention use and outcome evaluation. Chapter One provides an introduction and overview of the significance of IH interventions in community-based care, the importance of IH intervention evaluation, and the need for infrastructure enabling standardized data collection to evaluate the interventions. Chapter Two, the first manuscript, presents the current state of the science using informatics and artificial intelligence (AI) approaches to promote IH intervention delivery in nursing practice. Chapter Three, the second manuscript, describes an examination of the applicability of the Omaha System to represent IH interventions in large datasets, such as EHRs. Chapter Four, the third manuscript, presents the results of an analysis of IH intervention use and outcomes for clients receiving community-based care using a standardized Omaha System dataset. The final chapter, Chapter Five, synthesizes and interprets the overall findings across the three manuscripts, provides a discussion on the contributions of this research to the overall science, and outlines implications for future clinical practice and research.

Significance

The significance of this research is to expand the science using an informatics data-driven approach to enable standardized IH intervention data collection to describe IH interventions delivered and evaluate outcomes of the interventions in community-based care. This research increases knowledge about how standardized terminologies can facilitate documentation and representation of IH interventions in EHRs or other types of

clinical datasets. Use of the Omaha System allows standardized and structured IH intervention documentation and has the ability to contribute to shareable and comparable IH intervention data that is key to quality of care and leveraging the benefit of HIT (Elfrink et al., 2001; Zayas-Cabán et al., 2020). Analysis of structured IH intervention data to highlight hidden patterns is a novel approach that may have implications for nursing IH practice. The analysis procedure presented in this research may guide clinical administrators to evaluate their IH programs using local data to inform their quality improvement strategies and drive context-specific knowledge to support IH intervention delivery in community-based care or beyond.

Clinical Implications and Future Research

Findings from this research can advance the science of integrative healthcare and generate knowledge that may contribute to improvements in the use of IH interventions. Nurses may use the IH Omaha System target terms identified in this research to document their IH interventions in a structured and consistent form. Standardized IH intervention data may facilitate efficient communication between care providers and create opportunities for interprofessional collaboration. Analysis of the structured data may uncover information that is previously unknown and may inform clinical decisions on IH intervention use and further investigations. Next steps for this research are to include unstructured clinical data for allowing a deeper evaluation of IH intervention utilization and outcomes and to expand the approach presented in this research to examine IH interventions for other populations across healthcare settings.

Chapter 2

Informatics and Artificial Intelligence Approaches that Promote Use of Integrative Health Therapies in Nursing Practice: A Scoping Review

Introduction

Integrative health therapies are increasingly utilized as non-pharmacological and patient-centered strategies for managing health conditions. Integrative health therapies are whole person, person-centered, and relationship-based approaches encompassing biomedical and non-biomedical therapies based on scientific evidence for optimal health and well-being (Gaboury et al., 2012; Kreitzer & Koithan, 2018). Surveys indicated that the prevalence of IH therapy use among adults was 33.2%, 25.9%, and 63.1% in the U.S., European countries, and Australia, respectively (Clarke et al., 2015; Kemppainen et al., 2018; Steel et al., 2018). Integrative health therapies are especially sought by patients with chronic conditions for preventing future health problems, expanding treatment options, and maximizing well-being (Horneber et al., 2012; Saydah & Eberhardt, 2006; Wolever et al., 2012). Integrative health therapies have been recommended for managing several health conditions, such as pain, anxiety, and unpleasant side effects of biomedical therapies (Institute of Medicine of the National Academies, 2011; Pan et al., 2000; The Joint Commission, 2017). Numerous healthcare institutions have started programs to provide conventional Western medicine in conjunction with IH therapies (Cutshall & Pestka, 2018; Vohra et al., 2005).

Nurses, as healthcare professionals embracing a holistic approach, play a central role in the integration of conventional medicine and IH therapies in clinical contexts (Cutshall & Pestka, 2018; Griffin et al., 2016). Studies have shown that nurses are more

positive towards IH therapies and willing to learn and offer IH therapies than other professionals (Balouchi et al., 2018). A systematic review reported that 53.7% of nurses, on average, offered IH therapies to their patients (Chang & Chang, 2015). However, research has also revealed several barriers preventing nurses from offering IH therapies. Common themes include lack of knowledge, training, evidence, reliable sources of information, supportive facilities, peer support, time, regulations, and reimbursement (Jong et al., 2015; Kamizato et al., 2013; Metin et al., 2018; Zoe et al., 2014). Considerable efforts have been invested in promoting nurses' professional use of IH therapies (NCCIH, 2016). Informatics and artificial intelligence (AI) approaches have the potential to facilitate nurses' professional use of IH therapies through improving information management, supporting care, and capturing care for outcome evaluations (Delaney et al., 2013; Lan & Litscher, 2019; Lindquist et al., 2018).

Health informatics approach

Health informatics is a scientific discipline that integrates health, computer, information, and analytic science to facilitate and support healthcare delivery through managing and communicating data, information, knowledge, and wisdom (Nelson & Staggers, 2016). Informatics approaches include diverse information- and technology-based innovations that assist healthcare professionals with data collection and processing information for problem-solving, knowledge development, and decision making (Nelson & Staggers, 2016). Informatics approaches, such as EHRs, standardized terminologies, online computer applications, and wireless tracking devices, were highlighted as useful tools for promoting IH therapies use in nursing (Austin, 2018).

The EHR is a promising tool to enhance the quality of nursing documentation and

enable nursing data to be used in knowledge discovery and care quality improvement (O'Brien et al., 2015; Westra et al., 2016). For instance, Johnson and colleagues (2016) examined the effectiveness of nurse-delivered aromatherapy in a tertiary hospital using nurse-generated data. They concluded that patients' symptoms, including pain, anxiety, and nausea, were significantly ameliorated after receiving the therapy (Johnson et al., 2016). Another study using EHR data to explore the use of acupuncture for musculoskeletal disorder patients showed the prevalence of adverse events related to the therapies (Kim et al., 2016). The findings of these studies demonstrate the potential of EHR data for driving knowledge and promoting use of IH therapies in nursing.

Standardized terminologies further enable sharable and comparable nursing data for secondary use (Westra et al., 2008). Standardized nursing terminologies (SNTs) are collections of concepts that represent nursing practice in documentation for communication and evaluation of nursing care (Westra et al., 2008). The American Nurses Association (ANA) recognizes twelve SNTs supporting nursing documentation, interoperability of nursing data, and reuse of clinical data (Monsen, 2018; The Office of the National Coordinator for Health Information Technology, 2017). Previous studies demonstrated the feasibility of SNTs in capturing various nursing practices and enabling nursing data for knowledge discoveries (Tastan et al., 2014). However, the dominant work related to SNTs has focused on conventional nursing practices. A recent study revealed that Systematized Nomenclature of Medicine - Clinical Terms (SNOMED CT) captured only 42% of integrative therapy terms (Austin et al., 2019). The results highlighted a need for evaluating and expanding existing SNTs to improve the representation, interoperability, and usability of IH therapy data.

Despite limited attention on SNTs for IH therapies, some infrastructural work has been done to prepare the SNTs to capture nursing IH practice. Many evidence-based integrative care guidelines coded with the Omaha System, an ANA-recognized SNT, were developed as referencing resources for practitioners to guide their use of IH therapies and documentation using the Omaha System (*Omaha System Guidelines - Integrative Care*, 2015). These guidelines demonstrate how the Omaha System can be used to represent nursing IH therapies in a structured manner. With structured IH therapy data, a data-driven approach can be applied to evaluate the use and outcomes of nursing IH therapies for inspiring future research and informing clinical and policy decisions (Johnson et al., 2016; Kim et al., 2016; Monsen, Peterson, et al., 2017; Wool et al., 2015).

Artificial intelligence applications

Artificial intelligence is a branch of applied computer science that aims to develop computerized systems and robots to perform tasks that typically require human intelligence (He et al., 2019; National Science and Technology Council Committee on Technology, 2016). Several AI and robotic applications have been developed to support healthcare-related tasks, such as AI-aided diagnosis and intervention selections (Gu, 2019). The techniques have been applied to support professional use of IH therapies. For instance, a robotic application using image recognition techniques was developed to facilitate the localization and stimulation of acupuncture points (Lan & Litscher, 2019). Another example is the development of several companion and humanoid robots to facilitate animal-assisted therapies and psychotherapy for patients with cognitive impairments (Maalouf et al., 2018). All these applications demonstrated the applicability of such techniques for promoting use of IH therapies in nursing. Furthermore, researchers

have advocated using evidence-informed theoretical frameworks to guide development and evaluation of informatics and AI applications in supporting healthcare. Such theory-enhanced AI may improve the quality of applications and related data and outcomes (Scott et al., 2011, 2016; Wickramasinghe & Schaer, 2016).

Although the potential of informatics and AI approaches for promoting nursing IH therapies has been illustrated, the accumulative knowledge has not yet been systematically reviewed and synthesized. The purposes of this scoping review are to (1) describe the state of the science of informatics and AI approaches promoting nurses' use of IH therapies and (2) identify the gaps in literature for future investigations.

Materials and Methods

The current review followed the systematic review guideline published by the Centre for Review and Dissemination (Centre for Review and Dissemination, 2009). This review was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Extension for Scoping Reviews (Garritty et al., 2018).

Search strategy

A set of predefined keywords was used to search five electronic databases for identifying literature. The keywords included integrative medicine, integrative nursing, complementary therapy, traditional medicine, alternative therapy, holistic nursing, informatics, information technology, data science, electronic health record, artificial intelligence, and robot, as well as the synonyms of these terms. The databases included the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Ovid MEDLINE, Embase, Scopus, and Google Scholar. The Boolean operators and Medical Subject Heading terms were used to combine the keywords in order to maximize the

search. An example of the search strategy used to locate literature in Ovid MEDLINE is provided in Table 2.1. All searches were limited to the literature published in English between 2008 and 2018. The keywords and search strategies were determined with a senior research librarian. In addition, the chapters related to informatics in two textbooks, including the first and second edition of Integrative Nursing (Austin, 2018; Delaney et al., 2013), were reviewed for additional relevant literature. Furthermore, the citations of all included studies were reviewed to retrieve relevant references.

Table 2.1. Keywords and search strategy for Ovid MEDLINE

Search terms
1. (exp Informatics/ OR exp Information Technology/ OR exp machine learning/ OR exp latent class analysis/ OR exp decision trees/ OR exp Data Science/ OR exp Medical Records Systems, Computerized/) OR (big data or data science or informatic* OR electronic health record* OR electronic OR medical record* OR EHR* OR data mining OR decision tree* OR decision support OR machine learning OR deep learning OR latent class analysis).mp.
2. (artificial intelligence.mp. or exp Artificial Intelligence/) or (Robot*.mp. or exp Robotics/)
3. 1 OR 2
4. (exp *Complementary Therapies/ OR exp Integrative Medicine/ OR exp Holistic Nursing/ OR exp Medicine, Traditional/ OR ((integrative or traditional OR complementary OR holistic OR alternative OR non-pharmacolog* OR non pharmacolog*) adj2 (therap* OR medicine* OR health* OR healing OR modalit* OR nursing OR intervention*)).mp.)
5. Nurs*.mp.
6. 3 AND 4 AND 5
7. limit 6 to (English language and yr="2008 - 2018")
8. exclude (comment OR editorial OR letter or news OR "review" OR "systematic review")

Study selection

Abstracts of each study identified in the search were reviewed before being included. A set of eligibility criteria was used to screen each study. Inclusion criteria were: (1) described or evaluated informatics and AI approaches for promoting nurses' use of IH therapies during patient care, (2) original research, (3) focused on adult patient care, and (4) published as a full paper through a peer-reviewed process and in English. Exclusion criteria were: (1) proposed or discussed an informatics and AI approach that did not promoting nurses' use of IH therapies during patient care, (2) used phone calls, text messages, or emails that were not embedded in an information system to support nurses' use of IH therapies, (3) published as a review paper, comment, conference abstract, editorial article, thesis, or dissertation, and (4) reported in language other than English.

Data extraction

A data extraction tool reflecting the review purposes was developed to extract the relevant data elements from the included literature for evidence summary and synthesis. The data elements included authors, year of publication, study setting, research purpose, types of IH therapy, research design, sampling method, design and theoretical foundations of informatics and AI approach, method for the evaluation of the approach, study results (i.e., sample description, benefit of informatics and AI approach), implications, and limitations. An excel spreadsheet was used to organize the extracted data.

Data synthesis

Data from the included articles were synthesized following an analytical framework proposed by Arksey and O'Malley (Arksey & O'Malley, 2005). A descriptive

numerical summary method was used to summarize across the included articles for an overview of the current state and focus of the literature. Further, the studies were thematically organized according to different types of informatics and AI approaches.

Results

A total of 1,280 unduplicated articles were screened with title and abstract, and 1,224 articles were excluded according to the eligibility criteria. Fifty-six articles were reviewed with full-text, and 16 articles describing 14 studies were included in the current review. The PRISMA flow diagram of the literature screen is shown in Figure 2.1.

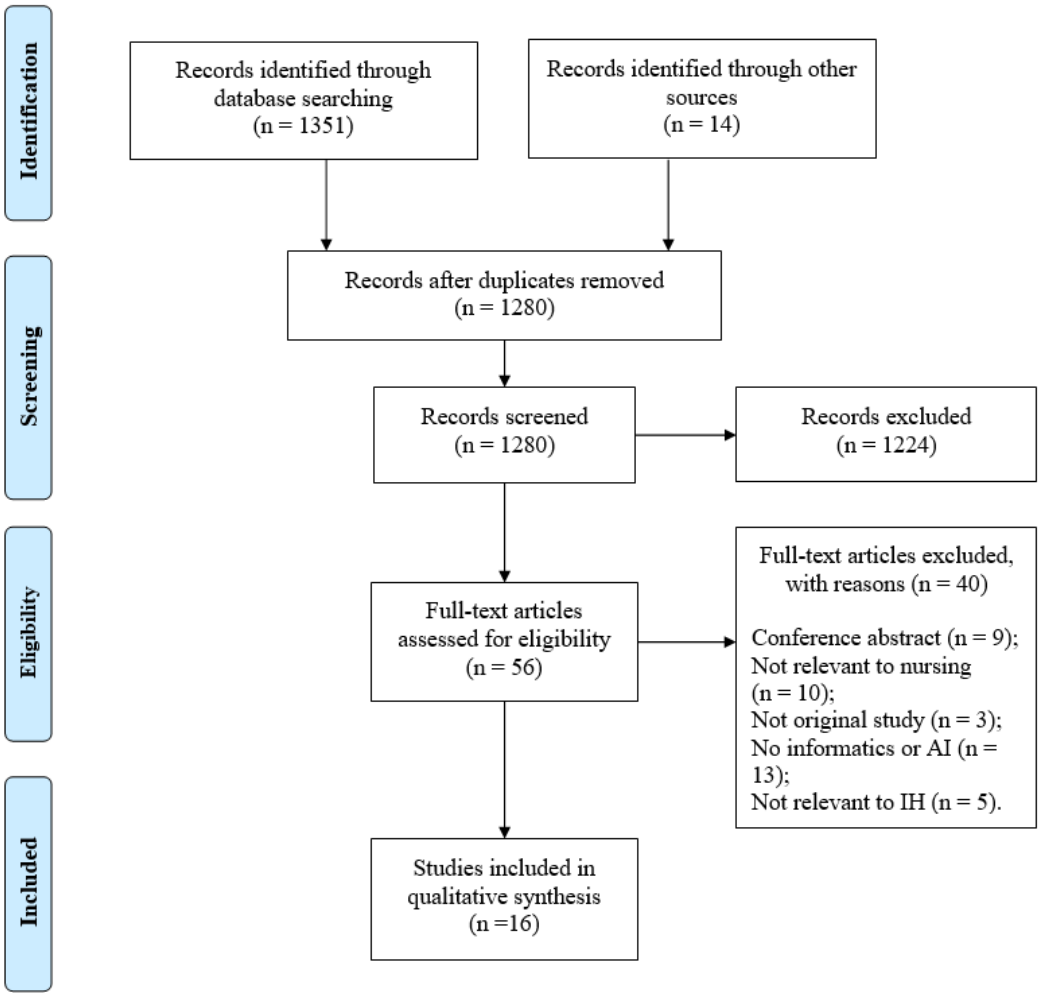

Figure 2.1. PRISMA flow diagram of study selection

Characteristics of included studies

The characteristics of the included articles are summarized in Table 2.2. Of the 14 studies, six used a quasi-experimental design with one group pre-/post-test or post-test only design (Boehmer & Karpa, 2011; Hou et al., 2015; Jallo et al., 2017; Krampe et al., 2016; Lopez-Samaniego & Garcia-Zapirain, 2016), two used a retrospective exploratory design (Hwang & Park, 2009; Schiff et al., 2012), two used a randomized controlled trial (RCT) (Fulmer et al., 2018; Moyle et al., 2018), one used cluster RCT (Jøranson et al., 2015, 2016), one used a mixed-methods design (Griffin et al., 2016), one used a qualitative design (Birks et al., 2016), and one used a cross-sectional design (Gao & Westra, 2012). Most of the studies were conducted in the United States (n= 7), followed by two in Australia, and one each in South Korea, Taiwan, Israel, Norway, and Spain.

For the types of IH therapy discussed in the studies, acupuncture (n=4) and animal-assisted therapy (n=4) were the most frequent IH therapies promoted by informatics and AI approaches, followed by guided imagery (n=2). Other therapies, including herbal and natural products (H/NP), biofeedback, psychotherapy, mind-body therapy, dance therapy, music therapy, acupressure, hypnosis, relaxation techniques, aromatherapy, reflexology, massage, oriental medicine, and traditional Chinese medicine (TCM) were each mentioned in one of the studies.

Typology of informatics and AI approaches

A fourfold typology emerged to label the informatics and AI approaches promoting nurses' use of IH therapies: robots with AI, computer- and mobile-based applications, electronic communication using an information system, and information standards and standardized terminologies. Definitions and examples of each type of informatics and AI approach are summarized in Table 2.3 and discussed in the following sections.

Robots with AI

The most prominent approach that emerged in this review is robots with AI that can drive the robots to support IH therapies through perceiving environmental changes and automatically adjusting robot actions. Six studies described and evaluated three different robots promoting animal-assisted therapy, psychotherapy, and biofeedback (Birks et al., 2016; Fulmer et al., 2018; Jøranson et al., 2015, 2016; Kramer et al., 2009; Lopez-Samaniego & Garcia-Zapirain, 2016; Moyle et al., 2013). Four studies described the use of companion pet robots that could respond to surrounding stimulations through sound and body movements to support animal-assisted therapy for older adults with dementia or cognitive impairments in long-term care facilities (Birks et al., 2016; Jøranson et al., 2015, 2016; Kramer et al., 2009; Moyle et al., 2013). Kramer and colleagues (2009) compared visitation programs by a person, a person with a live dog, and a person with a robotic dog for residents with dementia in a long-term care facility. The study suggested that the robotic dog could substitute for live dogs since it provided a higher amount of social interaction stimulation and generated fewer concerns about infection, animal care, and injury (Kramer et al., 2009).

Three studies discussed a companion pet robot with the appearance of baby harp seal (Birks et al., 2016; Jøranson et al., 2015, 2016; Moyle et al., 2013). Of them, two RCTs demonstrated the effectiveness of animal-assisted therapy using the robot on maintaining quality of life (Jøranson et al., 2016; Moyle et al., 2013) and decreasing symptoms of depression (Jøranson et al., 2015) and agitation (Jøranson et al., 2015) among older adults with moderate to severe dementia. One study qualitatively evaluating the robot from

Table 2.2. Descriptions of the reviewed studies

Reference	Purpose	Design	Type of IH	Setting	Informatics and AI approach	Theoretical foundations
Birks et al. (2016)	Explore the use of robotic seal as a therapeutic tool in aged care from the perspective of therapists	Qualitative interview	Animal-assisted therapy	Australia Aged care facility 127 beds	Robotic harp seal with sensors and AI software to learn its name, respond to sound and touch, and express emotions	Approach: NR Evaluation: NR
Boehmer and Karpa (2011)	Determine the degree to which a H/NP clinical decision tool met clinicians' needs by providing evidence-based information at the point of care	Quasi-experimental design One group pre- and post-test	Herbal and natural products containing plant-based herbals Not including multivitamin products and minerals	United States Medical center 484 licensed beds	Web-based clinical decision support system	Approach: NR Evaluation: NR
Fulmer *et al*. (2018)	Assess the efficacy of integrative psychological AI* on reducing depression and anxiety symptoms	RCT*	Psychotherapy (journaling, CBT*, and emotional support), relaxation strategies, and mindfulness-based therapy	United States 15 universities	Psychological AI chatbot	Approach: NR Evaluation: NR

Reference	Purpose	Design	Type of IH	Setting	Informatics and AI approach	Theoretical foundations
Gao and Westra (2012)	Evaluate the relevance of CCD* to TCM* practice	Cross-sectional survey	Traditional Chinese medicine	United States NR* in institutional scale	Information standard for IH therapies representation	Approach: NR Evaluation: NR
Griffin *et al.* (2016)[	Explore patterns of IH service referrals and the decision-making process	Retrospective exploratory design Qualitative interview	Acupuncture, massage, music, relaxation techniques, acupressure, mind-body therapy, and aromatherapy	United States Tertiary hospital 630 beds	Electronic consultation system for IH therapies referrals	Approach: NR Evaluation: NR
Hou, Chang, and Chen (2015)	Develop an information system for acupuncture treatment Evaluate the system in terms of patient safety, work efficiency, and timeliness of responses	Quasi-experimental design One group pre- and post-test	Acupuncture	Taiwan Medical center 1704 beds in total and 16 acupuncture treatment beds	Acupuncture treatment information system	Approach: NR Evaluation: NR
Hwang and Park (2009)	Explore the representation of the ISO RTM* in	Retrospective exploratory design	Oriental medicine	South Korea Tertiary teaching	Standardized terminology for IH therapies	Approach: NR Evaluation:

Reference	Purpose	Design	Type of IH	Setting	Informatics and AI approach	Theoretical foundations
	Oriental nursing interventions			Oriental medicine hospital 280 inpatient beds, 7 Oriental nursing care units	representation	NR
Jallo *et al*. (2017)	Examine the efficacy of mobile-based stress coping intervention for hospitalized pregnant women in high-risk of PTL, CS, or PPROM	Quasi-experimental design One group pre- and post-test	Guided imagery	United States NR in institutional scale	mHealth-based IH therapy intervention	Approach: NR Evaluation: NR
Jøranson et al. (2015)	Examine the effect of robot-assisted group activity in nursing homes for dementia people on symptoms of agitation and depression	Cluster RCT	Animal-assisted therapy	Eastern Norway 10 nursing homes NR in institutional scale	Robotic harp seal with sensors and AI software to learn its name, respond to sound and touch, and express emotions	Approach: NR Evaluation: NR

Reference	Purpose	Design	Type of IH	Setting	Informatics and AI approach	Theoretical foundations
Jøranson et al. (2016)	Examine the effect of robot-assisted group activity in nursing homes for dementia people on quality of life	Cluster RCT	Animal-assisted therapy	Eastern Norway 10 nursing homes NR in institutional scale	Robotic harp seal with sensors and AI software to learn its name, respond to sound and touch, and express emotions	Approach: NR Evaluation: NR
Karpa and Boehmer (2012)	Report non-primary care faculty's and nursing staff's use and experience regarding H/NP after using a Web-based clinical decision support system	Quasi-experimental design One group post-test	Herbal and natural products containing plant-based herbals Not including multivitamin products and minerals	United States Medical center 484 licensed beds	Web-based clinical decision support system	Approach: NR Evaluation: NR
Krampe *et al*. (2016)	Evaluate the feasibility and acceptability of a video conference software facilitating a dance-therapy program for older	Quasi-experimental design One group post-test	Dance -therapy	United States Assisted living facility NR in institutional scale	Computer-based IH therapy intervention	Approach: NR Evaluation: NR

Reference	Purpose	Design	Type of IH	Setting	Informatics and AI approach	Theoretical foundations
	adults					
Kramer *et al*. (2009)	Compare the social behavior of individuals with dementia during a one-on-one visitation by a person, a person with a live dog, and a person with a robotic dog	Quasi-experimental design One group post-test	Animal-assisted therapy	United States Home rehabilitation and health care center NR in institutional scale	Robotic dog with ability to sound, dance, and wave its front legs and AI software to respond to touch with sound and colored light flashing	Approach: NR Evaluation: NR
Lopez-Samaniego *et al.* (2016)	Design and implement a Lego-based robot for cognitive and behavioral maintenance for older adults using biofeedback	Quasi-experimental design One group post-test	Biofeedback	Spain Nursing home NR in institutional scale	Lego-based robot and biological sensors detecting electromyography and heart rate	Approach: NR Evaluation: NR

Reference	Purpose	Design	Type of IH	Setting	Informatics and AI approach	Theoretical foundations
Moyle *et al*. (2013)	Compare the effect of companion robots on emotions among people with moderate to severe dementia participating in an interactive reading group	RCT with cross-over design	Animal-assisted therapy	Australia Aged care facility 52 low-care and 62 nursing home beds	Robotic harp seal with sensors and AI software to learn its name, respond to sound and touch, and express emotions	Approach: NR Evaluation: NR
Schiff *et al*. (2012)	Explore the meanings and implications of an IH program through analyzing consultation reports associated with the IH service	Qualitative retrospective exploratory design	Acupuncture, reflexology, guided imagery, and hypnosis	Israel Medical Center NR in institutional scale	Electronic consultation system for IH therapies referrals	Approach: NR Evaluation: NR

Notes. AI: Artificial Intelligence; CBT: cognitive behavioral therapy; CCD: the Continuity of Care Document; CS: cervical shortening; EHR: electronic health record; H/NP: herbal and natural products; IH: integrative health; NR: not reported; PPROM: preterm premature rupture of membranes; PTL: preterm labor; RTM: reference terminology model; RCT: randomized clinical trial; and TCM: traditional Chinese medicine.

Table 2.3. Description of informatics approaches, example applications, and gaps for future research

Informatics approach	Description	Selected examples	Gaps for future research
Robots with AI	Develop, implement, and evaluate robot with AI that can drive the robot to support IH therapies through perceiving environmental changes and automatically adjusting robots' actions	Used a robotic harp seal to facilitate animal-assisted therapy (Birks et al., 2016) Applied a psychological AI chatbot to support individualized psychotherapy (Fulmer et al., 2018)	Attitudes of nursing staff towards robots assisting IH therapy delivery and their impacts on nursing Use of robotic applications in caring children, persons with disabilities, and other populations Comparison of robotic and live pets
Computer-and mobile-based applications	Develop, implement, and evaluate a computer- or mobile-based application to promote or facilitate IH therapies	Developed and evaluated a system for acupuncture treatment (Hou et al., 2015) Evaluated a web-based herbal and natural products decision support tool (Karpa & Boehmer, 2012) Evaluated a mobile application for stress coping (Jallo et al., 2017)	Unintended consequences pertinent to the applications
Electronic communication using an information system	Develop, implement, and evaluate a system to support communication and information sharing between nurses and IH practitioners	Used an electronic consultation system for IH* referrals (Griffin et al., 2016)	Detailed descriptions of IH communication systems for future implementation and improvements Use of electronic communication systems to promote IH communication in other healthcare settings, such as community-based care

Informatics approach	Description	Selected examples	Gaps for future research
Information standards and standardized terminologies	Develop, use, and examine an information standard or terminology to enable thorough, standardized, interchangeable nursing IH therapy documentation in electronic health records	Examined the usability of a pre-existing standardized terminology in presenting Oriental nursing interventions (Hwang & Park, 2009) Examined the relevance of CCD data elements to Traditional Chinese medicine practice (Gao & Westra, 2012)	Representation of the ANA-recognized SNTs to represent nursing IH therapies

Notes. *AI: artificial intelligence; CCD: the Continuity of Care Document; and IH: integrative health.

therapists' perspectives showed a positive attitude toward offering animal-assisted therapy when used by nurses in their practice (Birks et al., 2016).

The remaining two studies evaluated humanoid robots supporting psychotherapy and biofeedback (Fulmer et al., 2018; Lopez-Samaniego & Garcia-Zapirain, 2016). Fulmer et al. (2018) applied a psychological AI chatbot to deliver individualized interventions rooted in psychosocial modalities for college students to reduce symptoms of depression and anxiety. Their findings suggested that it is feasible and effective to use the chatbot to deliver emotional support using psychotherapy approaches for reducing depressive symptoms among college students (Fulmer et al., 2018). The second study described a robot with biological sensors to facilitate a biofeedback-based training game for physical and cognitive maintenance for older adults (Lopez-Samaniego & Garcia-Zapirain, 2016). The robot could move its arms to reflect participants' movements based on the data from a body movement sensor and adjust the difficulty of the game based on heart rate data from another sensor during the game. The study indicated the feasibility and acceptability of the robot in delivering personalized cognitive and motor rehabilitation for older adults (Lopez-Samaniego & Garcia-Zapirain, 2016).

Computer- and mobile-based applications

The second type of approach is computer-and mobile-based applications. Four included studies described and evaluated the use of this approach to promote nurses' IH therapy use (Boehmer & Karpa, 2011; Hou et al., 2015; Jallo et al., 2017; Karpa & Boehmer, 2012; Krampe et al., 2016). All studies used a quasi-experimental design with one group pre-/post-test or post-test only to evaluate their applications. Of their applications, one was developed as part of an EHR in a medical center to support clinical

use of acupuncture. The study showed that their acupuncture treatment system could enhance patient safety by providing order information at the point of care (Hou et al., 2015). Another application that was integrated into an EHR was a web-based decision support tool for the use of H/NP. The tool demonstrated the potential to promote safety of H/NP use by empowering nurses in providing the latest evidence (Boehmer & Karpa, 2011; Karpa & Boehmer, 2012).

The remaining two applications were not built as part of an EHR (Jallo et al., 2017; Krampe et al., 2016). Of them, one was a mobile-based application for facilitating guided imagery to reduce prenatal stress among hospitalized women at a high risk of preterm birth (Jallo et al., 2017). In addition to developing new applications, a pre-existing application can be applied to promote IH therapies. Krampe and colleagues (2016) applied a pre-existing conference communication software to facilitate a group-based dance therapy for older adults in an assisted living facility. Both applications enabled IH therapies to be delivered remotely and thus potentially enhanced the accessibility of the therapies.

Electronic communication using an information system

Another approach is using electronic communication systems to promote communication and information sharing between nurses and IH practitioners. Two studies described the use and evaluation of this approach (Griffin et al., 2016; Schiff et al., 2012). However, both studies provided limited descriptions regarding the use, advantages, and disadvantages of their communication systems. Griffin and colleagues (2016) explored the data from the consultation system and conducted qualitative interviews with users in a tertiary hospital. Their findings showed that most nurses and

physicians were satisfied with the referral process and remarked that the process worked well and was easy to follow (Griffin et al., 2016). Authors of the second study thematically analyzed the referral data from a medical center and revealed that an electronic consultation system could facilitate communication between IH practitioners and conventional healthcare providers (Schiff et al., 2012).

Information standards and standardized terminologies

The fourth type of approach is the use of information standards and standardized terminologies. The approach was defined as developing, evaluating, and using information standards and standardized terminologies to enable thorough, standardized, interchangeable IH therapy documentation within EHRs. Of the included studies, one study evaluated the usability of an international standards organization reference terminology model (ISO RTM) in representing Oriental nursing interventions in a tertiary Korean hospital (Hwang & Park, 2009). The findings revealed that a standardized terminology developed from a Western medicine perspective was applicable to represent Oriental nursing interventions and enable future research by providing structured data. The authors also indicated that the use of the ISO RTM decreased granularity in describing Oriental nursing interventions (Hwang & Park, 2009).

Another included study suggested that an existing information standard based on the biomedical model could promote the interoperability of IH therapy data. Gao and Westra (2012) conducted a cross-sectional survey of IH practitioners regarding the relevance of elements in the Continuity of Care Document (CCD) to IH therapy. The study concluded that most CCD elements are relevant and could be used to capture IH interventions and outcomes for information exchange among healthcare settings.

However, the study also suggested that a standardized terminology specifically delineating IH therapies should be developed to complement the CCD for sharing information between conventional and IH practitioners (Gao & Westra, 2012).

Gaps identified in this review

Serval gaps in the literature were identified for each approach and are summarized in Table 2.3. In addition, gaps across the approaches were identified. First, none of the included studies discussed the theoretical foundations of their informatics or AI applications and evaluation design. Furthermore, most studies used an observational design or a quasi-experimental design with a single group and a small sample. There is a need for theory-informed research with more rigorous design and a larger scale to provide robust evidence for implementing existing applications and future innovations.

Discussion

This review of the literature describes the scope of informatics and AI approaches supporting nurses' professional use of IH therapies to date. The informatics and AI approaches identified in this review were summarized and labeled by a fourfold typology, including robots with AI, computer-and mobile-based applications, electronic communication using an information system, and information standards and standardized terminologies. Informatics and AI approaches may enhance the safety, accessibility, and communication of nursing IH therapies, as well as enable nursing IH data for IH-related knowledge discovery.

The most common type of informatics and AI approach identified in the current review is robots with AI. All studies demonstrated positive results in using AI robots to promote IH therapies. It is notable that there is considerable interest in using robots to

support animal-assisted therapy for older adults with dementia and cognitive impairments, consistent with a previous review on the use of robots in nursing (Maalouf et al., 2018). The majority of reviewed studies evaluated their robotic applications from patients' perspectives or outcomes; additional research is needed regarding the attitude of nursing staff towards robots assisting IH therapy delivery (Broadbent et al., 2016). Further, although studies suggested that pet robots can substitute for live animals, none of the reviewed studies compared robotic and live pets from either patients' or therapists' perspectives. Thus, whether robotic pets can replace live animals and bring benefits suggested in the literature is unknown and should be further examined (Birks et al., 2016; Kramer et al., 2009; Moyle et al., 2013).

The second type of approach is computer- and mobile-based applications. Four studies described three computer-based software and one mobile-based application for facilitating the use of IH therapies by nurses. All demonstrated feasibility of promoting IH therapies, acceptability to clinicians, enhanced safety of IH therapy use, and increased accessibility of IH services. These advantages are consistent with the benefits of using computer- and mobile-based applications in conventional healthcare (Iribarren & Schnall, 2016; Seckman, 2018). However, all four studies used a quasi-experimental design, and the small sample size and single group design may bias the results (Shadish et al., 2002). More robust methods to test the applications are needed, such as a larger scale experimental and quasi-experimental design with comparison groups and longitudinal follow-up (Harris et al., 2006). Furthermore, unintended consequences pertinent to the applications were not explored. Given that computer- and mobile-based applications could have both positive and negative impacts on clinical practice (Debono et al., 2013),

the negative impacts of the applications have potential to offset their benefits and should be investigated.

The third type was electronic communication using an information system used to support nurses' use of IH therapies. The studies suggested that an electronic consultation system can make the referral smooth and facilitate the communication of patient information and treatments among IH practitioners and nurses. Such improved communication has potential to enable continuity of care, reduce cost by cutting redundant treatment, and improve quality of care (Liddy et al., 2013). A number of gaps in using the electronic communication system to promote IH therapy communication emerged in this review. First, the primary focus was on analyzing data collected in the systems for discovering knowledge regarding nurses' decision-making and communication in IH referrals. Descriptions of the design, utilization, and benefits of the systems were limited. Second, both studies were conducted in a tertiary setting. The utilization of an electronic communication system to promote IH communication in other healthcare settings is lacking, despite the fact that primary and community-based care practitioners frequently offer IH therapies to their patients and make IH referrals (Shirwaikar et al., 2013; Templeman & Robinson, 2011). Whether an electronic communication system can work well for and benefit those care providers needs to be explored in future studies.

The last approach identified in the current review is information standards and standardized terminologies that can enhance the quality, usability, and interoperability of IH therapy documentation. These studies highlighted the need for further development of standardized terminology to support thorough and structured nursing IH intervention

documentation. Limited scientific works related to the use of SNTs to enhance IH therapy documentation were identified with the search terms used in this review. None of the reviewed studies examined the representation of the ANA-recognized SNTs in nursing IH therapies. Although use of SNTs to capture IH practice is in its infancy, some work preparing the existing SNTs for documenting IH therapies has been done (Delaney et al., 2013; *Omaha System Guidelines - Integrative Care*, 2015). However, the majority of those works were presented in books and web sites. The extent to which those works can affect the quality and interoperability of nursing IH therapy documentation in real-world practice is unknown and needs to be further explored in the future.

None of the reviewed articles described the theoretical foundations of their approaches, consistent with previous literature urging the need for theoretical approaches to informatics and AI applications supporting healthcare (Caronongan III et al., 2016). Previous research has demonstrated that theories provide frameworks for guiding healthcare technology design, implementation, and evaluation (Maalouf et al., 2018; Scott et al., 2011; Wickramasinghe & Schaer, 2016). Informatics and AI approaches for nursing IH therapies should also be developed and evaluated based on evidence-informed theoretical frameworks. Several existing theories could be used to advance the science (Scott et al., 2016). For instance, the structure-process-outcome quality of care model or the Problem-Intervention-Outcome Meta-Model (Donabedian, 2005; Monsen, 2018) could provide theoretical foundations for comprehensive and structural examinations of innovative applications regarding their impact on healthcare and patient outcomes.

The implications of this review are many. Evidence suggests progress toward using informatics and AI applications to address some barriers to nurses' professional use

of IH therapies. For instance, AI robots may facilitate numerous IH therapies and facilitate providing both conventional and IH therapies. Lack of IH-related knowledge may be addressed using computer-and mobile-based applications to provide up-to-date knowledge at the point of care. In addition, all approaches identified were used in conventional healthcare, which may suggest that technology used in conventional nursing has potential to promote IH therapies. However, several technologies, such as expert systems and predictive analytics for nursing outcomes research, are not yet applied to support nursing IH therapies and should be scientifically evaluated.

This review has several limitations. First, the search terms for retrieving literature may fail to capture all relevant literature. Integrative health is not consistently defined in the literature, and numerous terms were used to represent IH therapies (Holmberg et al., 2012). Although the search terms for IH therapies were intentionally broad in this review, investigators may describe IH therapies with other terms. The same is true for informatics and AI approaches. In addition, the feasibility of applying advanced AI applications, such as machine learning techniques, to support IH therapies was demonstrated in previous studies (M. Chang & Zhu, 2017; Lan & Litscher, 2019). However, none of those techniques appeared in this review. Although this absence could be due to the literature databases and search terms used, it may also be true that advanced AI techniques have not been applied to support nurses' use of IH therapies.

Conclusions

The state of the science of informatics and AI approaches that promote nurses' professional use of IH therapies is that informatics and AI approaches may enhance the safety, accessibility, and communication related to nursing IH therapies, as well as

enabling nursing IH data for knowledge discovery. Informatics and AI approaches have potential to accelerate the integration of conventional and IH therapies for enhancing care quality and continuity of care. Further high-quality and theory-informed research is needed to advance use of informatics and AI in supporting nurses' use of IH therapies.

Chapter 3

Applicability of the Omaha System to Represent Integrative Health Interventions

Introduction

Integrative healthcare

Integrative healthcare (IH) advances the health and well-being of individuals, families, and communities through incorporating conventional healthcare and evidence-based complementary interventions using a relationship-based, patient-centered, and whole-person approach (Koithan, 2018; Snyder & Lindquist, 2018). Common complementary interventions include acupuncture, chiropractic, dietary supplements, energy therapies, mind-body therapies, and indigenous medicine from other cultures, such as Traditional Chinese Medicine. For the purpose of this study, IH interventions were defined as interventions that align with an IH approach and can be stand-alone interventions or used in combination with biomedical approaches.

Integrative healthcare interventions are increasingly offered within conventional healthcare as there is a growing acceptance by general and professional populations around the world (Johnson et al., 2016; Smeeding et al., 2010; Voss & Kreitzer, 2018). Previous investigators reported that approximately 54% of nurses had offered IH interventions to their patients (H.-Y. Chang & Chang, 2015). The primary purpose of IH interventions delivered by nurses was to manage patients' symptoms, including nausea, vomiting, anxiety, emotional upset, and chronic pain (Kamizato et al., 2013; Long, 2014; Metin et al., 2018). However, several barriers preventing nurses from offering IH interventions to their patients persist. Common restrictions include: (a) insufficient evidence exists to support certain IH interventions (Balouchi et al., 2018; Hall et al.,

2017); (b) nurses have limited information and knowledge about IH interventions (Hall et al., 2017); and (c) infrastructures, such as templates in electronic health records (EHRs) and standardized coding systems, to support IH intervention use and documentation are not readily available or do not exist (Austin, 2018; Lu et al., 2020; Taylor et al., 2019).

Informatics approaches and standardized terminology

Informatics approaches are widely adopted to support healthcare and have potential to address some of the barriers to nursing IH intervention delivery (Lu et al., 2020). Literature suggests that informatics approaches may promote IH intervention use through providing knowledge to healthcare providers at the point of care and enabling structured IH data collection for communication and knowledge discovery (Gao & Westra, 2012; Karpa & Boehmer, 2012; Lu et al., 2020). However, use of technology in IH substantially lags behind technology use in conventional healthcare. One reason for this is that the informatics infrastructure needed to enable the technology, such as decision support, for IH intervention delivery does not exist (Austin, 2018).

Researchers have highlighted that infrastructure enabling high quality, accessible, interoperable data collection within EHRs at the point of care is essential to leveraging informatics technology (IT) for supporting healthcare and research (Zayas-Cabán et al., 2020). Use of standardized terminology is a strategy to enable such data collection (Coenen et al., 2001; Westra et al., 2008; Zayas-Cabán et al., 2020). Standardized nursing terminologies (SNTs) are collections of phrases representing nursing concepts to support structured clinical documentation, human-computer interactions, and data interchange within EHRs (Monsen, Melton-Meaux, et al., 2011; Rosenbloom et al., 2006, 2008). There are twelve SNTs recognized by the American Nurses Association (ANA) to

support data collection in various nursing practices (Westra et al., 2008). Evidence has demonstrated that use of SNTs advances nursing through enhancing the quality of clinical documentation and communication (Feng & Chang, 2015; Tastan et al., 2014) and enabling nursing data for meaningful use and knowledge discovery (Dey et al., 2015; Martin et al., 2011; Monsen et al., 2010). However, none of the ANA-recognized SNTs has been tested and used to describe and document nursing IH interventions (Lu et al., 2020).

The Omaha System

The Omaha System, an ANA-recognized SNT, has potential to document and capture nursing IH interventions within EHRs (Kessler et al., 2020; Martin, 2005). The terminology is widely adopted to support clinical documentation, decision-making, and healthcare research in various settings (Martin, 2005; Martin et al., 2011; Slipka & Monsen, 2018; The Office of the National Coordinator for Health Information Technology, 2017; Topaz et al., 2014).

The Omaha System consists of three interrelated components for classifying client healthcare needs (the Problem Classification Scheme), interventions (the Intervention Scheme), and outcomes (the Problem Rating Scale for Outcomes). A concept map depicting the components of the Omaha System and their interrelationships is presented in Figure 3.1 (Monsen, 2009). The Problem Classification Scheme (the blue blocks and green oval at the bottom of Figure 3.1) is a holistic instrument comprising 42 defined health concepts (problems) to access healthcare needs in 4 domains.

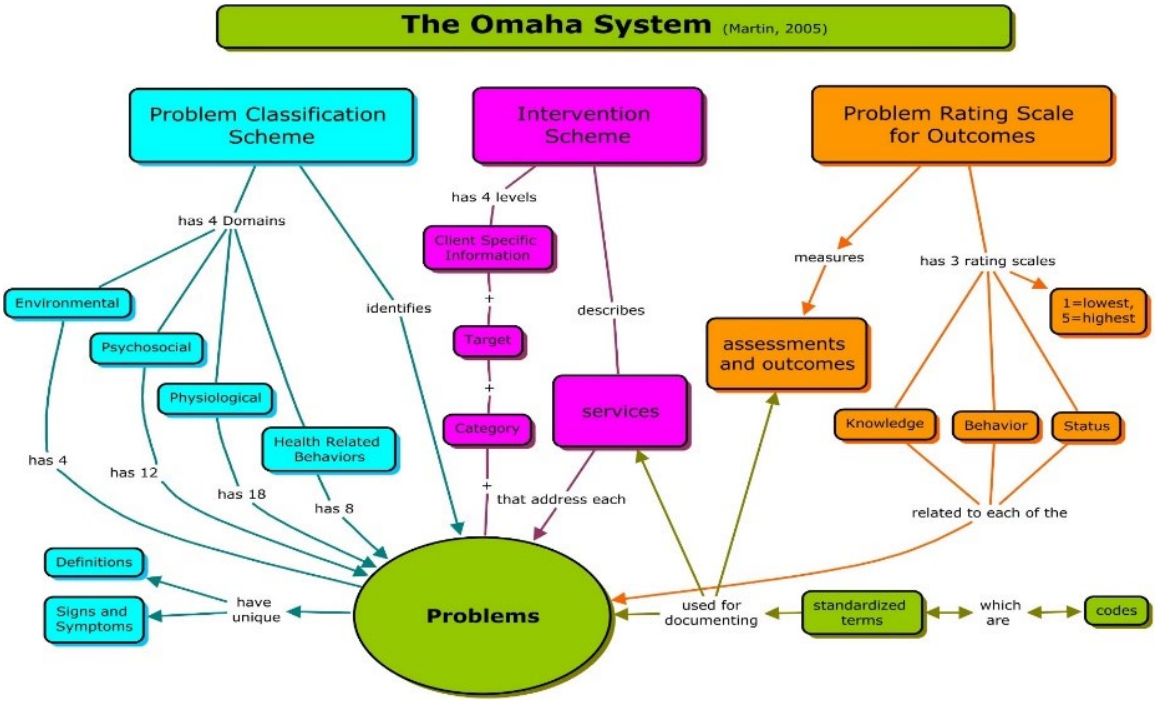

Figure 3.1. Concept map of the Omaha System (copyright Karen A. Monsen 2009, used with permission)

The Intervention Scheme (the purple blocks) defines 4 category terms, 75 targets, and a customizable care description for representing healthcare services (interventions) delivered. An intervention described using the Omaha System consists of a problem, a category, a target, and a care description. The problem specifies the topic of the intervention. The category term specifies healthcare a provider's action and activity. Four category terms were defined and can be used to address any of the 42 problems: Case Management; Surveillance; Teaching, Guidance, and Counseling; and Treatments and Procedures. The target term further describes actual content of the intervention. Targets are a set of defined terms to describe "unique objects of practitioner actions or activities that serve to further describe interventions" (Martin, 2005, p. 466). Target terms have been semantically examined and found to be useful in representing the actual content of interventions, including practice attributes (type of care and practitioner) and client

attributes (skills, needs, and environment) (Monsen, Melton-Meaux, et al., 2011). Lastly, care description is not standardized and can be individualized to provide detailed information about the intervention (Martin, 2005).

Kessler et al. (2020) developed an integrative nursing guideline for managing several symptoms using the Omaha System based on evidence and consensus of content experts. Specifically, the guideline suggested 111 IH interventions coded by the Omaha System Intervention Scheme to address 10 Omaha System problems representing health problems related to stress, anxiety, sleep disturbance, nausea, depressed mood, fatigue, pain, cognitive impairment, human spirit, and palliative care (Kessler et al., 2020). The guideline is available on the website of Omahasystemguidelines.org. In addition, the website contains several other Omaha System guidelines that suggested using IH strategies for managing health problems related to various symptoms, diseases, and conditions (Monsen et al., n.d.). These guidelines demonstrate the potential of the Omaha System for structured IH intervention documentation and knowledge representation within large datasets.

The objective of the study was to examine the applicability of the Omaha System to represent IH interventions. The focus of the study was an examination of the Omaha System Intervention Scheme to determine the applicability of each target term to represent IH interventions. The target terms were used because they are defined terms to further describe intervention content. Thus, once the applicability of the target terms to represent IH interventions is confirmed, the target terms can be used in combination with any problems, categories and care descriptions to document any nursing IH interventions and represent knowledge in large clinical datasets, such as EHRs.

Methods

Design

A classification procedure containing two steps, including initial classification and expert validation, was used to identify Omaha System target terms that are applicable to document and represent IH interventions. The study was deemed exempt from review by the University Institutional Review Board.

Procedure

Initial classification

The first author initially classified the Omaha System target terms applicable to represent IH interventions based on the definition of each Omaha System target term and existing evidence. Twelve standardized guidelines published on the website of Omahasystemguidelines.org (Monsen et al., n.d.) were selected as primary evidence for the classification based on the IH definition mentioned in the background section (Koithan, 2018; Snyder & Lindquist, 2018). The guidelines included Evidence-based Strengths, Social and Behavioral Determinants Interventions, Social Determinants of Health: Housing, Community health workers, Community-Dwelling Elders, End of Life/Palliative Care, Family Health Visit: Adult, Family Health Visit: Child, Core Intervention of Family Home Visit, Traditional Chinese Medicine, Low Back Pain, and Integrative Nursing Guidelines. Omaha System target terms presented in the guidelines were marked as IH targets.

Each Omaha System target term that did not present in any of the 12 Omaha System guidelines was then individually used as a keyword in combination with other IH keywords to search additional references on Ovid Medline. An example search strategy

for the respiratory care target is presented in Table 3.1. Omaha System target terms were also marked as IH targets if there were one or more systematic reviews indicating one or more effective IH interventions that can be represented by the target terms. Omaha System target terms that did not present in any Omaha System guidelines or integrative health literature were deemed as non-IH targets.

Table 3.1. Example evidence search strategy for determining the classification of Respiratory care target

Search terms	
1.	(exp Integrative Medicine/ OR exp Complementary Therapies/ or Integrative health.mp. or complementary health approach.mp.)
2.	(respiratory function.mp. or pulmonary function.mp.)
3.	1 AND 2
4	Limit 3 to (English language and yr="2008 - 2018")

Expert validation

An excel spreadsheet containing all Omaha System target terms and their definitions, initial classification, and evidence supporting the classification were sent out through email to three Omaha System and integrative nursing experts for review. The experts were asked to independently review the classification and note their results in the spreadsheet by indicating “agree”, “disagree”, or “undecided” with the initial classification according to their expertise. Comments from the experts were synthesized and addressed for finalizing the classification. A 100% agreement among experts was needed for confirming the classification for each target term. Target terms noted as undecided by one or more experts were classified as their original classification and are discussed in the discussion section.

Results

A total of 75 target terms were initially classified based on the Omaha System

guidelines and literature. The classification yielded 46 (61.3%) target terms that can represent IH interventions. Of the 46 IH targets, 41 (89.1%) were presented in 4 Omaha System guidelines on average (range from 1 to 8) and representing 10 IH interventions on average (range from 1 to 32). Five (10.9%) IH targets were determined based on existing systematic reviews showing positive results. The mean number of the systematic reviews used to support the classification was 6 (range from 2 to 12).

Expert agreement with the initial classification resulted in 69 (92.0%) target terms deemed accurately classified. Experts had differing opinions on six target terms (8%): Anatomy/physiology; Bowel care; Cast care; Education; Medication administration; and Nursing care. Expert comments (Table 3.2) were reviewed and addressed for the final IH target list. One expert commented that the anatomy/physiology, bowel care, cast care, and education targets have potential to represent nursing IH interventions despite no existing guideline or evidence identified to support the classification in this study.

The medication administration target was classified as an IH target in the initial classification since the target is used in the Omaha System Integrative Nursing guideline to represent the administration of essential oil for aromatherapy. One expert disagreed and argued that essential oils are not considered as medication according to the Food and Drug Administration. In addition, one expert suggested that the nursing care target should be an IH target. The rationale behind the suggestion was that nursing is imperative to integrative healthcare and embraces an integrative approach for a long history. According to expert comments, the medication administration target was removed, and the nursing care target was added (see Appendix A Finalized IH Omaha System targets).

Table 3.2. Expert comments on Omaha System targets with disagreements on initial classification.

Target	Definition	Initial mark	Reviewer decision	Suggestions
Anatomy/ physiology	Structure and function of the human body	N	Undecided	Much of IH has an impact on anatomy, such as muscle relaxation, or physiology such as increased perfusion to tissues (massage) or decrease in pain sensations such as acupressure
Bowel care	Activities that promote bowel function such as bowel training and enemas	N	Undecided	Bowel care could be supported by diet, herbal therapies, exercise, fluid intake
Cast care	Activities that promote cleanliness, dryness, support, alignment, and relief of pain, pressure, and construction of an injured body part immobilized by a cast, splint, or other devices	N	Undecided	Cast care could cover therapies such as perfusion, oxygenation, movement, paresthesia, pain, etc. IH interventions could be used in these therapies
Education	Formal programs that offer general technical or individualized studies for students of all ages	N	Undecided	Education on integrative health could be very valuable to the client/provider
Medication administration	Activities that involve applying or giving medications and that are completed by clients, parents/caregivers, or health care providers	Y	Disagree	Aromatherapy is not considered a medication by the Food and Drug Administration
Nursing care	Assessment/diagnosis and treatment provided by nurses and their staff or assistants	N	Disagree	Nursing is imperative to integrative health

Note. N: non IH target; Y: IH target; and IH: integrative health

Discussion

Integrative healthcare interventions are increasingly utilized in conventional nursing care to advance health and wellness of individuals, families, and communities. Use of SNTs to represent nursing IH interventions delivered enables standardized, accessible, and interchangeable data for leveraging IT to support nurses' professional use of IH interventions (Austin, 2018; Lu et al., 2020; Zayas-Cabán et al., 2020). This study examined the applicability of Omaha System target terms to represent IH interventions based on existing evidence and expert validation. These findings suggest that Omaha System target terms are broadly applicable to represent IH interventions. This study is a precursor study to enable standardized and structured IH intervention data collection at the point of care and further creates opportunities to reuse the data for supporting knowledge discovery.

In this study, 46 (61.3%) target terms were found to be applicable to represent IH interventions. This finding may suggest that generating structured nursing IH intervention data using the Omaha System to support technology use and research is possible. Further, the high applicability reflects that the Omaha System Intervention scheme is a comprehensive and holistic taxonomy covering the whole spectrum of healthcare services. This finding aligns with previous research demonstrating that the Omaha System is applicable to acute care, palliative/end-of-life care, and community-based care (Martin, 2005; Monsen, Schenk, et al., 2015; Slipka & Monsen, 2018). Use of these 46 target terms may enable standardized IH intervention data collection that is critical for constructing predictive models and clinical decision support systems (Martin et al., 2011; Monsen, Peterson, et al., 2017; Zayas-Cabán et al., 2020). Further, the full definition of

an intervention in the Omaha System is the Problem-Category-Target-Care description (P-C-T-CD) combination. The analysis of the target terms will aid in pursuing further elucidation of IH interventions based on P-C-T-CD strings which are more complex to model. Further research is needed to examine the feasibility of using the 46 target terms in combination with problems, categories, and care descriptions to facilitate nursing IH intervention documentation at the point of care.

On the other hand, twenty-nine (38.7%) target terms were deemed to be not applicable to IH intervention representation in this study. These target terms were considered more likely to represent conventional healthcare interventions. Examples of these target terms include durable medical equipment, feeding procedures, genetics, infection precautions, laboratory findings, specimen collection, and six medication-related targets. These target terms may reflect the differences in philosophy and approach between conventional and integrative healthcare (Koithan, 2018).

A few Omaha System target terms, including anatomy/physiology, bowel care, cast care, and education, remained debatable regarding their applicability to represent IH interventions and were not classified as IH targets in this study. Determining the classification of these target terms was a challenge due to the flexibility of the Omaha System. Whether these Omaha System target terms can be used to represent IH interventions depends on how healthcare providers and researchers understand and use the target terms. For example, an expert noted that the bowel care target can represent dietary supplements, herbal therapies, excise, fluid intake, and any other interventions enhancing bowel function. However, these interventions can also be represented by other Omaha System target terms that are undoubtedly applicable to IH intervention

representation, such as dietary management and exercise targets. This finding aligns with a previous study that suggested adding sub-headings to target terms further specified the objects of healthcare providers' actions or activities without increasing the number of target terms (Monsen, Melton-Meaux, et al., 2011). Furthermore, analyzing care description data related to these target terms within real-world documentation to understand the utilization of these target terms may address the conundrum and provide better insights into classifying these target terms (Farri et al., 2011).

A limitation for this study was inherent in knowledge representation using standardized terminologies. Considering the broad range of IH interventions, a single terminology may not cover all types of IH interventions and their corresponding terms. Although the Omaha System allows flexible documentation via care description to specify actual content of interventions provided, care description data are not coded and thus require advanced techniques, such as natural language processing, for meaningful use. One solution that may fill this gap is using the Omaha System in combination with other standardized terminologies that provide granular codes for clinical concepts and actions. For example, care description data can be coded using Systematized Nomenclature of Medicine - Clinical Terms (SNOMED CT) for allowing data reuse analysis. However, the applicability of other standardized terminologies to capture IH interventions is unknown and needs further research (Lu et al., 2020).

Using the Omaha System to collect standardized IH intervention data has many implications. First, standardized IH data can be used to drive novel knowledge to advance the science of integrative healthcare. This study creates an opportunity to explore real-world nursing IH data for intervention use and outcome evaluations and construct

predictive models to support clinical decisions. Specifically, further research can use the IH targets identified in this study to operationalize IH interventions in EHRs or other types of nursing datasets for the evaluations. This may address the need for knowledge and evidence supporting IH intervention delivery by nurses at the point of care. In addition, use of the Omaha System may enhance the quality and completeness of IH intervention documentation for efficient, consistent, and structured communication between healthcare providers and across healthcare settings. Such communication is key to quality of care and reducing cost by eliminating redundant interventions (Hwang & Park, 2009; Saranto et al., 2014; Wang et al., 2011). Furthermore, structured and complete IH intervention documentation makes the value of nursing IH interventions visible and quantifiable for informing decisions on resource allocation and policymaking (Häyrinen et al., 2010).

Conclusions

Complete and interchangeable IH intervention data are critical for leveraging IT for supporting the integration of conventional and integrative healthcare. The applicability of the Omaha System to represent IH interventions was examined in this study. Findings suggest that the Omaha System is broadly applicable to represent IH interventions. Specifically, 46 Omaha System target terms were found to be applicable to represent IH interventions. Use of the 46 IH target terms in combination with problems, categories, and care descriptions may facilitate efficient and thorough IH intervention documentation at the point of care and enable sharable and comparable IH data for clinical practice, program evaluation, and decision-making. It is also possible to use the 46 IH target terms to locate IH interventions in large clinical datasets for understanding

IH intervention use and outcomes. Further study is needed to examine the acceptability and usefulness of the Omaha System in supporting IH data collection.

Chapter 4

Describing Integrative Health Intervention Use and Outcomes in Community-based Care

Introduction

Integrative health (IH) interventions are increasingly utilized in conventional healthcare to advance patient well-being and manage a broad array of health conditions (Snyder & Lindquist, 2018). IH interventions are person-centered, relationship-based approaches encompassing diverse evidence-based strategies, including both biomedical and complementary therapies, to advance human health and well-being (Gaboury et al., 2012; Koithan, 2018). Previous research has demonstrated the safety and effectiveness of several IH interventions on managing symptoms, including pain, depression, insomnia, and anxiety (Clark et al., 2019; Romeo et al., 2015). As the scientific basis of IH interventions increased, more and more healthcare institutions started offering IH interventions in conjunction with routine care (Cutshall & Pestka, 2018; Taylor et al., 2019).

Nurses have practiced several IH interventions, such as meditation, massage, active listening, and presence, for centuries (Kreitzer, 2015; Snyder & Lindquist, 2018). Authors of a review of previous investigations reported that 53.7% of nurses on average had offered IH interventions or referrals to patients in practice; however the variability in IH definitions and measurements among the studies existed (Chang & Chang, 2015). Common purposes of nursing IH interventions were to improve wound healing, manage intestinal symptoms, and alleviate anxiety, depression, insomnia, pain, fatigue, nausea, and vomiting (Kamizato et al., 2013; Metin et al., 2018). Numerous nurse-delivered IH

interventions have been found to be effective (M. Harris & Richards, 2010; Johnson et al., 2016; Meghani et al., 2017a, 2017b). For instance, authors using electronic health record (EHR) data examined the effectiveness of nurse-delivered aromatherapy and reported that pain, anxiety, and nausea of patients were reduced after receiving the therapy (Johnson et al., 2016). Common IH interventions in nursing practice include massage, meditation, relaxation techniques, aromatherapy, touch, herbal supplements, music therapy, and acupuncture (H.-Y. Chang & Chang, 2015; Kamizato et al., 2013). While efforts have been made to investigate IH intervention use in nursing practice, the number and outcomes of IH interventions in real-world practices are unknown. Furthermore, the majority of previous investigations focused on acute care or institution-based settings. It is unknown how IH interventions are utilized and how the interventions contribute to patient outcomes in community-based care.

The adoption and use of standardized terminology for nursing documentation of community-based care in EHRs create opportunities to examine IH intervention use and outcomes. Standardized terminologies are collections of vocabulary facilitating structured clinical knowledge representation and communication (Tastan et al., 2014). Clinical data documented using standardized terminology are useful in program evaluation and knowledge discovery (Martin et al., 2011; Monsen, 2018; Monsen, Brandt, et al., 2017). Specifically, using a standardized terminology can quantify nursing interventions within clinical documentation for utilization and outcome evaluations. The Omaha System, a widely adopted standardized terminology, is found to be useful in facilitating structured community-based care data collection for intervention evaluation (Gao et al., 2019; Martin, 2005; Monsen et al., 2010). The Omaha System consists of three valid, reliable,

and interrelated components: The Problem Classification Scheme, the Intervention Scheme, and Problem Rating Scale for Outcomes. The Problem Classification Scheme is an instrument assessing clients' health-related problems. The Problem Rating Scale for Outcomes is used to measure client progress in relation to problems (Martin, 2005). A detailed description of these two components is provided in the Methods section of this paper.

The Intervention Scheme supports documentation of services delivered by healthcare professionals using Problem-Category-Target-Care description (P-C-T-CD) combinations. For each combination, the problem specifies the topic of the intervention. The category depicts a healthcare provider's action. There are four categories that can be used in combination with any target to address any problem: Teaching, Guidance, and Counseling (TGC), Surveillance, Treatments and Procedures (TP), and Case Management (CM). The target further describes the unique object of the category to specify the content of the intervention. Seventy-five targets are defined in the Omaha System. Care description is not defined and can be customized to specify detailed information about any intervention, care plan, and program.

The applicability of the Omaha System to represent nursing IH interventions in EHRs or other types of datasets has been examined (See Chapter 3). Forty-six Omaha System targets applicable to IH intervention representation were identified based on existing evidence and content expert validation (see Appendix A). The 46 targets can be used to capture IH interventions within clinical datasets for identifying IH intervention use through a data-driven approach. Furthermore, as the Omaha System describes interventions using P-C-T-CD combinations, the association between problems and IH

interventions can be examined to understand the purposes of IH interventions.

Research Questions

The purpose of this study was to examine IH intervention use and outcomes using an Omaha System dataset generated during routine documentation of community-based care. Three specific aims of this study were to understand: (1) what is the percentage of IH interventions delivered in community-based care; (2) what are patterns in IH intervention utilization in community-based care; and (3) what is the association between IH interventions and client outcomes after controlling for demographics, service characteristics, and baseline assessments?

Methods

Design

This study was a retrospective, observational study analyzing an existing nurse-generated dataset using the Omaha System. The University Institutional Review Board deemed this study exempt from review. The data used in this study were stored in a secure data shelter managed by the University of Minnesota Academic Health Center. Data access and analysis were performed following the regulations of the Center.

Sample

A de-identified dataset generated in community-based care between 2012 and 2018 by agencies across the United States was used. All clients without missing data in demographic variables in the dataset were included. There were 17,576 clients with 3,213,691 interventions and 101,808 outcomes in the subset. Clients were separated into age-based cohorts (Children: 0-12, Adults: 13-49, and Older adults: 50+ years of age) based on the distribution of the sample and clinical knowledge regarding their services.

Measures

The Omaha System was the instrument used to operationalize clients' problems and IH interventions and measure client outcomes.

Problems

Clients' problems were documented using the Omaha System Problem Classification Scheme in the dataset. The Omaha System has 42 defined problem concepts, each of which falls under one of four domains: Environmental, Psychosocial, Physiological, and Health-related Behaviors. In addition, all of the 42 problems have a unique set of signs/symptoms for specifying individual needs (Martin, 2005).

Integrative health interventions

All intervention data in the dataset were documented using the Omaha System Intervention Scheme and represented by P-C-T combinations. All P-C-T combinations were dichotomously categorized into IH or non-IH interventions based on their targets using the IH target list mentioned in the Background section (see Appendix A). Of the 46 IH targets, signs/symptoms-physical, medical/dental care, and nursing care targets were deemed more likely to represent conventional healthcare interventions in the context of community-based care in the U.S. and thus were not used in this study. Care description data was not available to the dataset.

Client outcomes

Client outcomes were measured using the Omaha System Problem Rating Scale for Outcomes. The scale measures Knowledge (what the person knows), Behavior (what the person does), and Status (the number and severity of the person's signs/symptoms) with Likert-type ordinal scales from 1, the worst rating, to 5, the best rating. Each client

problem involved in this analysis was rated using the Knowledge, Behavior, and Status (KBS) ratings at admission and discharge. To accommodate clients who were unable to express their knowledge, such as infants, knowledge of their primary caregivers/parents was rated. Validity and reliability of the rating scales were established as the terminology developed (Martin, 2005).

Demographic and clinical variables

The demographic variables used in this analysis included age, sex, race, and marital status. Age was measured in years, and dichotomous measures were used to measure sex (1: male or 0: female), race (1: white or 0: nonwhite), and marital status (1: married or living together or 0: single). Clinical variables included clients' numbers of problems, signs/symptoms, visits, interventions, and IH interventions, and mean KBS ratings at admission.

Analytic Strategy

Descriptive statistics, including mean, frequency, and standard deviation, were used to describe the demographic and clinical characteristics by groups. For aims 1 and 2, client interventions (P-C-T combinations) were pooled within each group. The percentages of IH interventions was calculated by dividing the total number of IH interventions by the total number of interventions for each group. Differences in the percentages of IH interventions between groups by domains, problems, categories, and targets were examined using analysis of variance, chi-square test, and Fisher's exact test where appropriate.

For aim 3, Hierarchical multiple regression analysis was applied to examine the extent to which the number of IH interventions predict clients' overall outcomes (KBS

ratings at discharge) after controlling demographics (sex, race, and marital status), baseline assessments (number of problems and signs/symptoms and KBS ratings at admission), and service characteristics (number of visits) for the entire sample. All statistical tests were performed using R statistical software package version 3.6.2.

Results

Sample characteristics

Of the 17,576 clients, 11.5% were children, 65.3% were adults, and 23.2% were older adults. Demographic and clinical characteristics by groups are summarized in Table 4.1. There were significant between-group differences in all characteristics.

Table 4.1. Client demographics and clinical characteristics by groups.

Group	Children (n=2,013)		Adults (n=11,481)		Older (n=4,082)	
Characteristics	% or Mean	SD	% or Mean	SD	% or Mean	SD
Age* (years)	2.39[a]	2.7	26.3[b]	6.9	76.0[c]	12.4
Sex*						
Male	49.13%		15.4%		42.7%	
Female	50.87%		84.6%		57.4%	
Race*						
White	79.2%		84.6%		90.9%	
Nonwhite	20.8%		15.4%		9.1%	
Marital status*						
Married or living together	0.0%		43.6%		41.0%	
Single	100.0%		56.4%		59.0%	
No. of Visits*	23.3[a]	16.6	33.8[b]	19.8	44.7[c]	31.8
No. of SS*	1.5[a]	2.4	3.76[b]	4.8	12.3[c]	8.9
No. of Problems*	4.0[a]	3.1	5.8[b]	4.3	17.0[c]	11.0
Baseline assessment						
Knowledge*	3.2[a]	0.7	3.1[b]	0.6	3.2[c]	0.6
Behavior*	3.8[a]	0.7	3.7[b]	0.7	3.7[b]	0.7
Status*	4.1[a]	0.7	4.0[b]	0.8	3.6[c]	0.8
No. of interventions*	100.1[a]	157.84	144.4[b]	245.4	331.7[c]	548.57
No. of IH interventions*	71.8[a]	119.7	95.4[b]	169.3	127.8[c]	229.3

Group Characteristics	Children (n=2,013) % or Mean	SD	Adults (n=11,481) % or Mean	SD	Older (n=4,082) % or Mean	SD

Note. No: Number; and SS: signs/symptoms.
* $p < .05$;
[a,b,c]: Means that have no superscript in common were significantly different from each other (Tukey's HSD, $p <. 001$)

Percentages of IH interventions

The percentages of IH interventions were 71.8%, 66.0%, and 38.5% for children, adults, and older adults, respectively. Children received a significantly higher percentage of IH interventions ($\chi^2 = 252{,}593, df = 2, p < .001$).

Patterns in IH interventions delivered

Different patterns in IH interventions delivered among groups were detected at domain, problem, category, and target levels. Problems in Environmental and Psychosocial domains were more likely to be addressed using IH interventions for all groups (all p <.001) (Figure 4.1). The percentages of IH interventions for problems in all four domains differed significantly by groups (all p <.001).

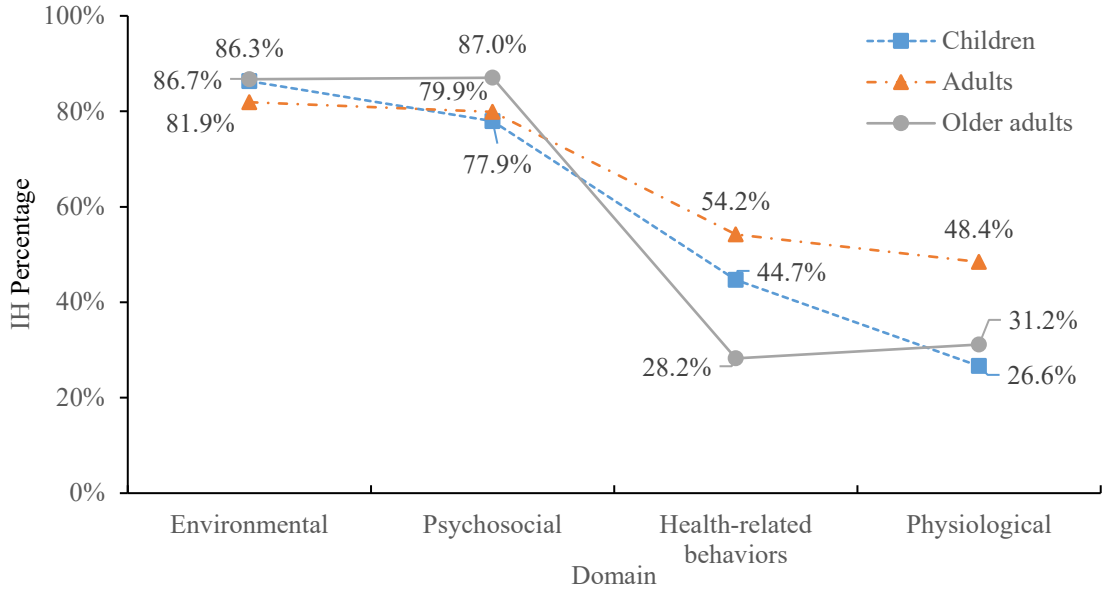

Figure 4.1. IH intervention percentages by problem domain and group

Problems frequently addressed by IH interventions (≥ 80%) for all groups included Spirituality, Interpersonal relationship, Social contact, Neighborhood/workplace safety, Role change, Grief, Speech and language, Cognition, Mental health, Sanitation, and Residence (Figure 4.2). In contrast, Consciousness, Communicable/infection condition, Pain, Bowel function, and Medication regimen were the problems less frequently addressed by IH interventions (≤ 20%) for all groups. Significant between-group differences were found in percentages of IH interventions for all problems except Spirituality, Role change, Speech and language, and Consciousness (all p <.05).

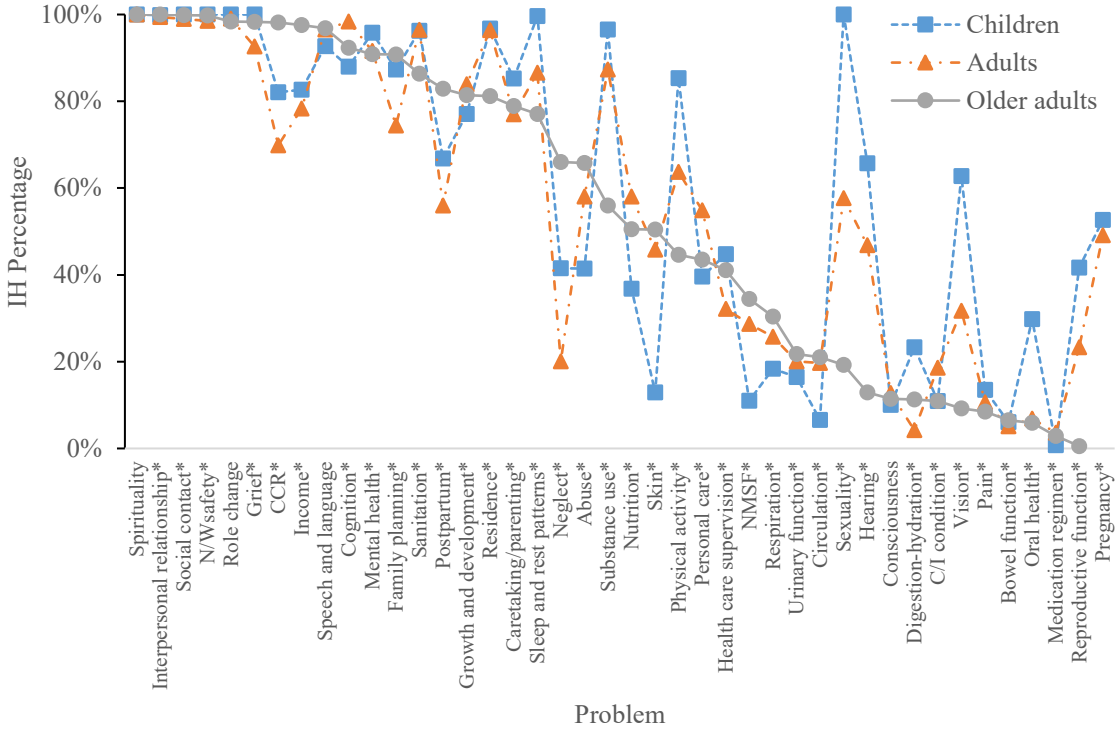

Figure 4.2. IH intervention percentages by problem and group

Note. C/I condition: Communicable/infectious condition; CCR: Communication with community resources; N/W safety: Neighborhood/workplace safety; and NMSF: Neuro-musculo-skeletal function;

* Significant differences between groups p < .05.

For all groups, TGC interventions were more likely to be IH interventions, while TP interventions were less likely to be IH interventions (p <.001 for all) (Figure 4.3). Interventions in all four categories were less likely to be IH interventions for older adults (p <.001 for all).

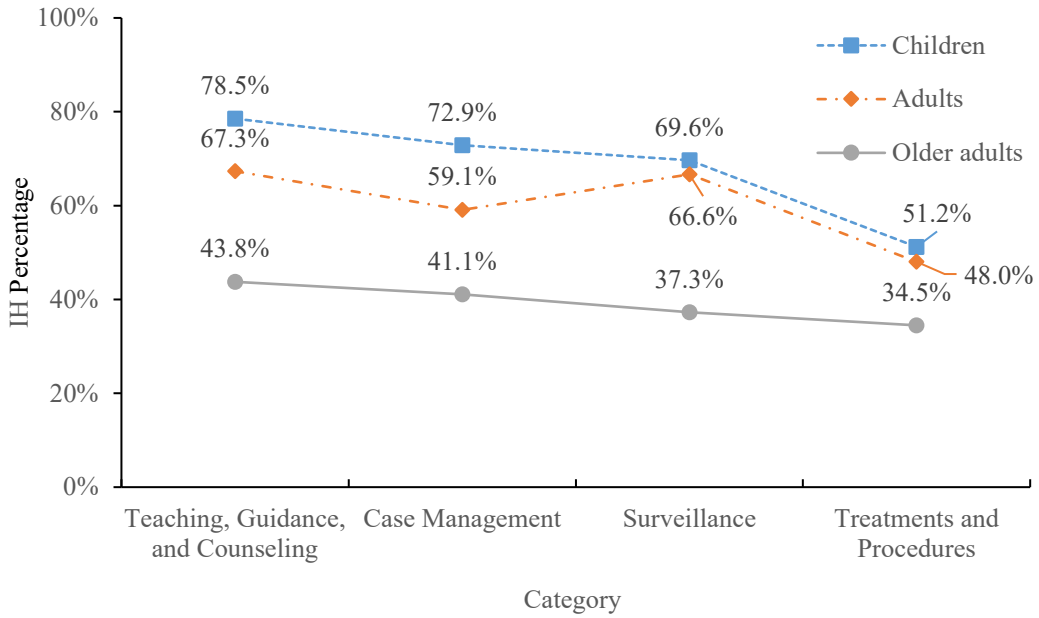

Figure 4.3. IH intervention percentages by category and group

Analysis at the target level revealed that the frequencies of all 43 IH targets also differed by groups (all p <.001) (Figure 4.4). Growth/development care was the most frequent IH target for children, while signs/symptoms-mental/emotional was the most frequent IH target for adults and older adults.

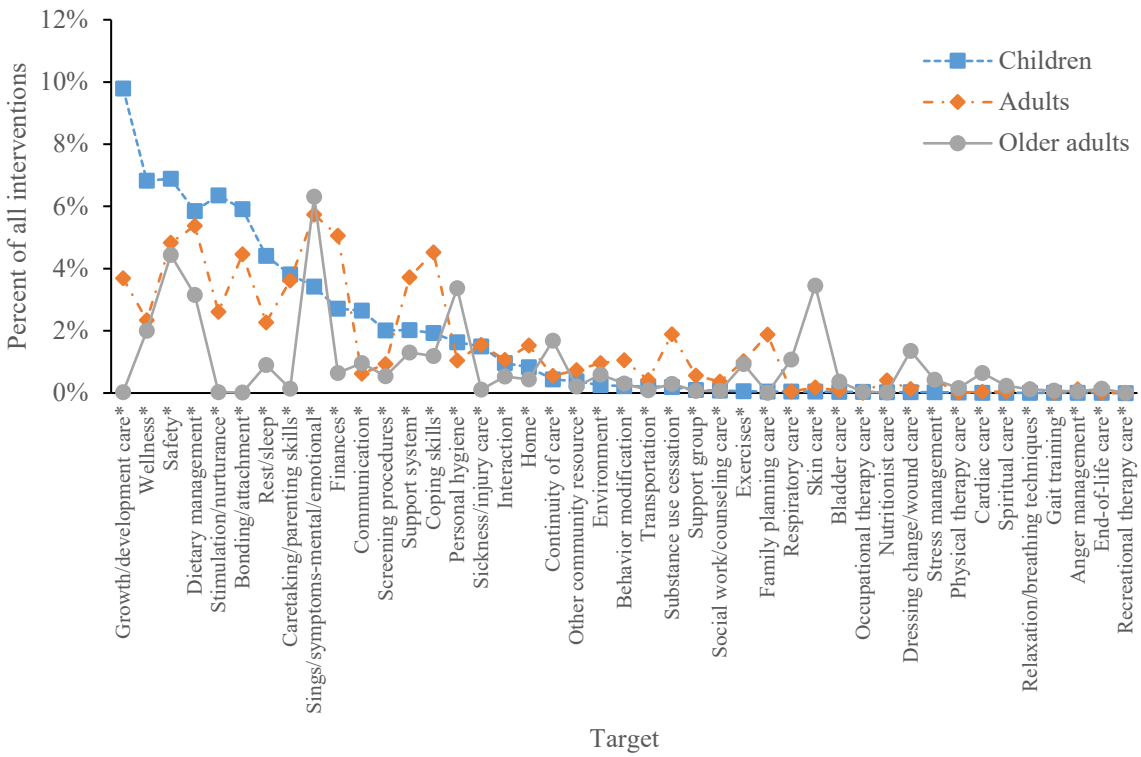

Figure 4.4. Frequencies of IH Omaha System target terms by group

* Significant differences between groups $p < .05$.

Association of IH interventions to KBS ratings

Hierarchical multiple regression analysis indicated that the number of IH interventions was associated with higher KBS ratings at discharge (Knowledge: $F(9, 17566) = 3872$, $p < .001$; Behavior: $F(9, 17566) = 5810$, $p < .001$; and Status: $F(9, 17566) = 7403$, $p < .001$). Other associated factors are shown in Table 4.2. The models explained 66.5%, 74.8%, and 79.1% of the variance in Knowledge, Behavior, and Status ratings at discharge, respectively. Of the models, the number of IH interventions alone explained 0.4% of the variance in Knowledge rating ($F(1, 17566) = 196.6$ $p < .001$) and 0.1 % of the variance in Behavior ($F(1, 17566) = 65.6$, $p < .001$) and Status ($F(1, 17566) = 48.7$, $p < .001$) ratings at discharge.

Table 4.2. Hierarchical multiple regression of factors related to KBS ratings at discharge for total sample (N = 17,576)[a]

Predictor variables	Knowledge	Behavior	Status
Step 1: Demographics			
Age	-.04***	-.01	<.01
Sex	-.01**	-.02***	-.01**
Marital status	.01	.02***	.01***
Race	.03***	.02***	.03***
R2	.018***	.024***	.043***
Step 2: Baseline assessments			
Baseline score	.81***	.85***	.87***
Number of Problems	<.01	.03***	.01*
Number of Signs/symptoms	-.03***	-.05***	-.04***
R2	.659***	.747***	.790***
ΔR2	.641***	.722***	.746***
Step 3: Service characteristics			
Number of Visits	.03***	.03***	.02***
R2	.661***	.748***	.791***
ΔR2	.002***	.001***	.001***
Step 4: IH interventions			
Number of IH interventions	.07***	.04***	.03***
R2	.665***	.748***	.791***
ΔR2	.004***	.001***	.001***

[a] All standardized regression coefficients were from Step 4
* $p < .05$
** $p < .01$
*** $p < .001$
Note. IH: integrative healthcare.

Discussion

This study examined IH intervention use and outcomes for clients receiving community-based care using a clinical dataset documented using the Omaha System. The results showed that IH interventions were more frequently used to address children's healthcare needs, while IH interventions were less frequently used on older adults. Patterns in IH interventions delivered differed by group at domain, problem, category, and target levels. This finding suggests that clinicians tailored their care based on clients' needs, consistent with previous research (Gao et al., 2019; Monsen, Brandt, et al., 2017).

Hierarchical linear regression analysis indicated that the number of IH interventions was associated with higher KBS ratings at discharge, after controlling for demographics, service characteristics, and baseline assessments. Use of the Omaha System facilitates the examination of nursing IH intervention use and outcomes within large clinical datasets. Omaha System domains and Problem-Category-Target combinations provide a useful framework to explore differing patterns in IH interventions delivered among populations. To our knowledge, this is the first study exploring the IH intervention use and outcomes in community-based care using an existing nursing dataset. Further research is needed to validate these findings using different datasets.

Percentage of IH interventions delivered in community-based care

More than 65% of interventions delivered to children and adults were IH interventions. This finding aligns with the trend towards the integration of conventional and integrative healthcare for symptom management and well-being across the continuum of healthcare (Cutshall & Pestka, 2018; McClafferty, 2019; Smeeding et al., 2010; Vohra et al., 2012). Older adults received the lowest percentages of IH interventions. This finding may suggest that community-dwelling older adults have distinctive healthcare needs that require more conventional healthcare interventions. Further research exploring the unique needs of older adults may provide an understanding of the reasons for the different strategies used.

Patterns in IH interventions delivered differed by population

Integrative health interventions delivered varied between groups in problems, categories, and targets. The finding supports the notion that different populations have unique care needs, and clinicians tailor their care toward the needs (Horning et al., 2018;

Monsen, Brandt, et al., 2017; Monsen, Radosevich, et al., 2011). Despite the variation, a few patterns consistent across the groups were revealed. Problems in the Environmental and Psychosocial domains were more likely to be addressed by IH interventions for all groups. More than 80% of interventions addressing problems in the Environmental domain were IH interventions for all groups. This finding may suggest that IH interventions are more suitable for addressing problems such as Income, Sanitation, Residence, and Neighborhood/workplace safety, consistent with the fact that community-based care advances human health and well-being through addressing social, economic, and environmental problems using a holistic approach from a whole-person perspective (Koithan et al., 2018).

Regarding problems in the Psychosocial domain, previous investigators reported similar results indicating that common purposes of nursing IH interventions were to address clients' mental and emotional illness (Kamizato et al., 2013; Metin et al., 2018). However, previous research indicated that IH interventions were also frequently used to ameliorate physiological problems, such as pain, constipation, and wounds (Kamizato et al., 2013; Metin et al., 2018). The inconsistency may be explained by the differences between settings and countries of the studies. Further analysis of full P-C-T combinations may provide better insight into the reasons for using different approaches by healthcare providers to address physiological problems in community-based care.

Several problems were less frequently addressed using IH interventions. Notably, the result indicated that the primary pain management strategy in community-based care was conventional healthcare approaches. Previous investigators have suggested the safety and effectiveness of IH interventions in managing acute and chronic pain for a variety of

populations (Johnson et al., 2016; Meghani et al., 2017a, 2017b). Incorporating IH approaches into pain management is recommended by professional associations, such as the Joint Commission (The Joint Commission, 2017). Additional investigation is needed to explore the reasons for the low adoption of IH interventions to client pain management in this setting.

For all groups, TGC interventions were more likely to be IH interventions, while TP interventions were less likely to be IH interventions. This finding suggests that the majority of informative interventions in community-based care are from a holistic, person-centered, and relationship-based perspective, and TP interventions are substantially on the basis of conventional healthcare approaches focusing on biological defects. An explanation of this finding may be the lack of knowledge, skills, evidence, and reimbursement to support IH intervention delivery in nursing (Balouchi et al., 2018; Hall et al., 2017). Additional qualitative research may be needed to reveal the reasons for this pattern with clinicians providing care in community settings.

IH intervention use predicts higher outcomes

The notion that IH interventions have potential to advance overall health and well-being of clients receiving community-based care (Koithan et al., 2018) is supported by this study. The numbers of IH interventions were positively associated with clients' KBS ratings at discharge after controlling for demographics, service characteristics, and baseline assessments. This finding is also consistent with previous studies reporting that numerous nurse-delivered IH interventions were effective, while the variability in populations and study settings among studies exists (M. Harris & Richards, 2010; Johnson et al., 2016; Meghani et al., 2017a, 2017b).

Strengths and Limitations

A strength of this study includes utilizing real-word data generated in community-based care to evaluate IH intervention use and outcomes. This study has the usual limitation of a retrospective, observation study reusing existing data generated in practice. No cause-effect relationship between IH intervention use and client outcomes, as well as other factors, can be inferred in this study due to lack of randomization and other controls. Instead, the associations and patterns revealed in this study can guide future experimental and quasi-experimental studies.

The definition used to operationalize IH interventions in this study was broad and based on two assumptions: (a) the IH target list was comprehensive enough to capture all IH interventions correctly in community-based care; (b) the IH targets were exclusively used to document IH interventions. The IH target list was identified based on existing integrative health evidence and terminology and integrative nursing content expert validation; hence, the list was assumed to be thorough. The assumption should be examined by further research evaluating the usefulness of the IH targets in IH intervention documentation. With the dataset used, it was not possible to know that all interventions with IH targets were actually IH interventions. More data, such as care descriptions, are needed for a more accurate IH intervention classification. Nevertheless, consistency between several findings of this study and previous literature lends credibility to the assumptions and suggests that the approach used to capture and evaluate IH interventions in this study is promising.

International implications for nursing practice

As use of IH interventions increases around the world, evaluations of IH

intervention use and outcomes are essential to assure quality of care. This study demonstrated a methodology leveraging clinical documentation to support the evaluations at a population level using the Omaha System, a standardized terminology translated into 13 languages and used by more than 22,000 practitioners around the world (The Omaha System, 2017). The terminology provides a way to capture IH interventions within existing clinical data and a framework to evaluate IH intervention use and outcomes. Patterns in IH intervention use may provide information to inform nurses' decisions on IH intervention use and identify gaps for future studies to expand knowledge about integrative healthcare.

Conclusions

Integrative health interventions delivered in community-based care were examined within an existing clinical dataset documented using the Omaha System. The findings revealed that IH interventions accounted for a substantial number of interventions delivered in community-based care and led to optimal KBS outcomes for clients. Unique patterns in IH interventions delivered were also revealed among each population. These results suggested that a standardized terminology, such as the Omaha System, is useful in capturing IH interventions within clinical documentation for intervention use and outcome evaluation that may have implications for clinical practice, research, and policymaking. Research should continue to validate the findings of this study using other datasets and terminologies.

Chapter 5

Synthesis

This chapter highlights the results of this research and the contribution of the findings to the body of science. The importance of the three manuscripts and their implications for further nursing practice and research are discussed. The purpose of this research was to develop a data-driven approach for evaluating IH intervention use and outcomes for clients receiving community-based care using standardized clinical data. Three specific aims of this research were: 1) To operationalize IH interventions using standardized terminology based on previous work and evidence; 2) to describe and compare the use of IH interventions delivered in community-based care; and 3) to evaluate the extent to which IH interventions predict client outcomes, after controlling for demographics, baseline assessments, and service characteristics. Findings of this research can advance the science of using standardized terminologies to leverage clinical data to support nursing IH practice and research. Analysis of standardized IH intervention data provides insights into current IH practice in community-based care and has potential to expand knowledge about integrative healthcare.

Result synthesis and interpretation

This research adopted an informatics approach to capture, describe, and evaluate IH intervention use and outcomes in a standardized clinical dataset using the Omaha System. An informatics approach is a multidisciplinary approach that incorporates computer science, information science, and clinical knowledge to develop informatics applications to enable and utilize data to improve healthcare (Nelson & Staggers, 2016). A review of literature revealed that informatics approaches have potential to support

nursing IH intervention delivery, and infrastructure is needed to enable structured data collection to leverage the benefits of the approaches (Zayas-Cabán et al., 2020). Examining the applicability of the Omaha System to represent IH interventions found that the terminology is broadly applicable to represent IH interventions and may enable standardized IH intervention data collection at the point of care. Using the Omaha System to capture IH intervention data in a clinical dataset allowed a thorough analysis of nursing IH intervention delivery and outcomes in community-based care.

The review of literature provided an understanding that HIT used in conventional nursing has potential to support nursing IH intervention delivery. However, the use of HIT in nursing IH practice lagged behind the use in conventional nursing. Another finding highlighted that nurses may benefit from using standardized terminologies to facilitate standardized IH intervention and outcome data collection for clinical communication and knowledge discovery. The data collection at the point of care is an essential infrastructure for leveraging HIT, such as decision support systems and predictive analytic, to support IH intervention use in nursing (Zayas-Cabán et al., 2020). A key finding from the review showed that it is feasible to document and capture IH intervention delivery in EHRs using existing standardized terminologies, such as the Omaha System. Identified gaps in this review supported a need to understand how existing standardized terminologies can facilitate documentation and representation of nursing IH interventions in EHRs for knowledge discovery and enabling HIT to support the intervention use.

Examining the applicability of the Omaha System to document and represent nursing IH intervention use revealed that generating shareable and comparable IH

intervention data is feasible using the Omaha System (Aim 1). A total of 46 (61.3%) Omaha System target terms were deemed to be applicable to represent IH interventions based on existing evidence and content expert validation. On the other hand, 29 (38.7%) Omaha System target terms were deemed to be not applicable to IH intervention representation. Of these 29 target terms, four remained disputable regarding their applicability to represent IH interventions due to lack of expert consensus and evidence support. The results suggested that the Omaha System is applicable to capture IH interventions delivered within EHRs or other types of clinical datasets for meaningful use and may have capability to facilitate structured IH intervention documentation at the point of care. Structured IH intervention data allowed analysis to understand IH intervention utilization and evaluate outcomes of the interventions in real-world settings.

Use of the Omaha System created the opportunity for reusing clinical documentation to evaluate IH intervention use and outcomes in community-based care. A de-identified clinical dataset generated during routine documentation of community-based care using the Omaha System was used to capture IH interventions delivered to children (n = 2,013), adults (n = 11,481), and older adults (n = 4,082) and evaluate the association between IH interventions and client outcomes (Aims 2 & 3). The data revealed a significant difference ($p < .001$) in the frequencies of IH interventions among children (71.9%), adults (66.0%), and older adults (38.5%). Patterns in IH interventions delivered differed by group at domain, category, and target levels ($p < .001$ for all). Patterns in the data indicated that problems in the Environmental and Psychosocial domains were more likely to be addressed by IH interventions regardless of groups ($p < .001$ for all). Data indicated that Spirituality, Interpersonal relationship, Social contact,

Neighborhood/workplace safety, Grief, Role change, Speech and language, Cognition, Mental health, Sanitation, and Residence were the problems addressed by IH interventions for all groups frequently (≥ 80%). Significantly lower percentages of IH interventions for older adults were found in all four categories ($p < .001$ for all). Comparing IH interventions by category revealed that TGC interventions were more likely to be IH interventions, and TP interventions were more likely to be non-IH interventions for all groups ($p < .001$ for all). Analysis at target level identified that growth/development care was the most frequent IH target for children, while signs/symptoms-mental/emotional was the most frequent IH target for adults and older adults.

Hierarchical multiple regression analysis indicated that the number of IH interventions was associated with higher KBS ratings at discharge (Knowledge: $F(9, 17566) = 3872$, $p < .001$; Behavior: $F(9, 17566) = 5810$, $p < .001$; and Status: $F(9, 17566) = 7403$, $p < .001$). The regression models explained 66.5%, 74.8%, and 79.1% of the variance in Knowledge, Behavior, and Status ratings at discharge, respectively. After controlling for demographics, baseline assessments, and service characteristics, the number of IH interventions significantly increased the adjusted R^2 by 0.4% for the model of Knowledge rating ($p < .001$) and 0.1% for the models of Behavior and Status ratings at discharge ($p < .001$ for both).

Discussion

This research found that it is feasible to use a data-driven approach to capture IH intervention data within EHRs for intervention utilization and outcome evaluations that may have implications for healthcare teams and researchers. The Omaha System enabled

the ability to collect and capture structured IH intervention data. Use of the data allowed further analyses using advanced data analysis techniques, such as data visualization, to uncover hidden patterns in nursing IH intervention delivery and evaluate the outcomes of the interventions.

Literature suggested that informatics approaches have potential to enhance safety, accessibility, and communication related to nursing IH intervention delivery and facilitate IH data capture for knowledge discovery. This aligns with the benefits of informatics applications used in conventional healthcare (Cummins et al., 2018; Schlachta-Fairchild et al., 2018; Seckman, 2018). A means to collect and capture IH intervention data in a standardized form to allow secondary use of the data in research and enable the use of informatics applications, such as decision support systems and predictive analytic, to support nursing IH intervention use is lacking. Previous research showed the potential of standardized terminologies to facilitate structured IH intervention data collection and capture for meaningful use (Austin, 2018; Gao & Westra, 2012; Kessler et al., 2020). The gaps identified in the literature review supported the next steps of this research.

This research found that the Omaha System is broadly applicable to represent IH interventions and has potential to facilitate standardized IH intervention data collection at the point of care. The ability to document and capture standardized IH intervention data is essential for leveraging HIT to support nursing IH intervention delivery and research (Zayas-Cabán et al., 2020). The structured data may be used to construct predictive models and enable decision support systems that provide evidence to support IH intervention use at the point of care (Kawamoto & Fiol, 2016; Martin et al., 2011). Furthermore, standardized IH intervention data may allow comprehensive evaluations of

IH intervention use and outcomes in real-world practices (Austin, 2018; Martin et al., 2011; Monsen et al., 2010). An in-depth understanding of IH intervention utilization and effectiveness may help healthcare providers tailor their care to the unique needs of each individual, policymakers to develop best practice guidelines, and researchers to determine whether a new intervention is needed.

Use of the Omaha System to operationalize IH interventions in an existing clinical dataset generated in community-based care enabled data analysis to explore utilization and evaluate outcomes of IH interventions. The analysis revealed previously unknown knowledge about IH intervention utilization in community-based care. For instance, the analysis conducted in this research showed that IH interventions accounted for a substantial number of interventions in community-based care, especially for children and adults. Additionally, visualizing structured clinical data revealed numerous differing patterns in IH interventions delivered among children, adults, and older adults. These patterns suggested that data visualizations provided an ability to discover novel patterns that may be otherwise not possible to reveal and provide insights into clinical practice and future research, consistent with previous studies (Gao et al., 2019; Monsen, Peterson, et al., 2015; Monsen, Swenson, et al., 2017).

This research also showed that it is feasible to provide knowledge about associations between patient outcomes and IH interventions through analyzing standardized clinical data. The associations may serve as preliminary evidence supporting researchers to conduct further studies with prospective designs (Monsen, 2018; NCCIH, 2016). These findings demonstrated the feasibility of using standardized clinical data and data-driven approach to enable nursing IH intervention use and outcome evaluations that

may have implications for advancing the practice and science. To our knowledge, this is the first research utilizing existing clinical data to examine IH intervention use and outcomes for clients receiving community-based care. More research is needed to verify these findings using other datasets representing the same or different populations.

Importance of Manuscripts

Each manuscript identified gaps in and made contributions to the science and provided direction for each subsequent manuscript. All three manuscripts together present a methodology utilizing a data-driven approach to evaluate IH intervention use and outcomes reusing structured clinical data. The first manuscript, *Informatics and Artificial Intelligence Approaches that Promote Use of Integrative Health Therapies in Nursing Practice: A Scoping Review*, reviewed the current state of the science and identified the gaps in knowledge of HIT use in supporting nursing IH intervention use. This provided foundational support to evaluate the applicability of existing standardized terminologies to document and represent IH interventions within EHRs.

The second manuscript, *Applicability of the Omaha System to Represent Integrative Health Interventions*, showed that it is possible to document and capture nursing IH intervention data within EHRs using the Omaha System. Knowledge gained from examining the applicability of the Omaha System to represent IH interventions provided a foundation and the ability to generate standardized IH intervention data at the point of care for clinical practice, program evaluation, and decision-making. This manuscript also established a way to operationalize IH interventions in clinical datasets for further analysis to understand IH intervention use and outcomes.

The third manuscript, *Describing Integrative Health Intervention Use and*

Outcomes in Community-based Care, captured IH interventions from an existing clinical dataset generated during routine documentation of community-based care using the method developed in the second manuscript. Analysis of the intervention data provided an exemplar for reusing clinical documentation to examine IH intervention use and outcomes. Differing patterns in the data were revealed and may provide new insights to inform future practice and research. Positive association between IH interventions and outcomes for clients provides support to further IH intervention use and development.

Future Research

This research introduces a pathway for future informatics research to support nursing IH intervention delivery and outcome measurement. Specifically, this research establishes a foundation for generating structured IH intervention data at the point of care and enabling a data-driven IH intervention measurement reusing clinical data. Future research should be directed toward validation of these findings through qualitative and prospective research, inclusion of unstructured clinical data to enable deeper analysis, and expanding the approach presented in this research to examine IH intervention delivery and outcomes for other populations.

Further research should be directed toward validation of these findings through qualitative and prospective research with clinicians providing care in community settings. The usual limitations of retrospective studies that reuse data generated in practice apply to this study. Therefore, the findings of this research should be interpreted with caution. In particular, this research revealed several new patterns in IH intervention use in community-based care, including IH intervention use differed by age, there were fewer IH interventions for physiological problems, and there were fewer IH interventions for

the Pain problem concept. Qualitative and prospective research is needed to validate these patterns before deriving conclusions.

Further research could be directed toward use of the Omaha System in combination with other terminologies and data analysis techniques to include unstructured clinical data to enable deeper analysis. Care description data was not available to this research and thus not included in the analysis. Inclusion of care description data may enable a more precise IH intervention classification and provide additional information about the intervention utilization. However, analysis of care description data is a challenge due to the unstructured format of the data. Use of other terminologies, such as Standardized Nomenclature of Medicine -- Clinical Terms (SNOMED CT), to code care description data would allow analyzing the data. Another approach to enable the inclusion of care description data is utilizing techniques such as natural language processing (NLP). The ability to include care description data may facilitate deeper analysis of IH intervention use and provide more detailed information to inform practice and future research.

Last, future research could be directed toward expanding the approach presented in this research to examine IH intervention delivery and outcomes for other populations across healthcare settings. This research used community-based care as an exemplar for demonstrating the data-driven approach for evaluating IH intervention use and outcomes. Since the increasing trend in IH intervention use appears in settings across the care continuum, the information about current IH practice and outcomes in other settings would also be valuable and help to inform better decisions on IH intervention use.

Implications for Nursing Practice

This research focused on enabling structured IH intervention data capture and use of data-driven approaches to evaluate IH intervention use and outcomes using existing clinical data. Standardized terminologies facilitate efficient, structured, and consistent communication between healthcare providers and across healthcare sectors via enhancing the quality, completeness, and consistency of clinical documentation (Tastan et al., 2014; Westra et al., 2008). The IH Omaha System target terms identified in this research have potential to enable standardized IH intervention documentation at the point of care. Nurses can use the target terms in combination with the Omaha System Problem Classification Scheme and the Omaha System Problem Rating Scale for Outcomes to document IH interventions and outcomes structurally and efficiently. The ability to generate standardized IH intervention data is an infrastructure for leveraging informatics approaches to support nursing IH intervention delivery (Austin, 2018; Zayas-Cabán et al., 2020).

Additionally, this research demonstrated a data-driven approach utilizing existing clinical data to evaluate IH interventions and discover knowledge. Use of the approach would allow administrators to evaluate their programs using clinical data for an understanding of their current practice and insights to enhance their care quality. Furthermore, several patterns in IH intervention use were revealed in this research and may provide insights into nursing IH practice and future research. The positive association between IH interventions and outcomes for clients revealed in this research also supports future use and further development of IH interventions in community-based care.

Conclusion

Infrastructure that enables standardized IH intervention data collection is needed to leverage informatics approaches to promote IH intervention use in nursing. This research found that use of the Omaha System has potential to enable standardized IH intervention data collection and operationalization for meaningful use. Analysis of structured IH intervention data found that IH interventions accounted for a substantial number of interventions in community-based care and were associated with optimal outcomes for clients. Visualizing the data provided the ability to understand how the interventions were used in real-world settings and detect differing patterns in IH intervention use in terms of type, amount, and purpose at population levels. Further research should examine the usefulness and acceptability of the Omaha System in IH documentation and continue to validate the approach and findings of this research.

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Appendix A

Finalized IH Omaha System targets and definitions (Martin, 2005, pp. 374–376)

Target	Definition	Used
Anger management	Activities that decrease or control negative feelings and interactions, including violence	Y
Behavior modification	Activities that change habits, conduct, or patterns of action	Y
Bladder care	Activities that promote bladder function such as bladder retraining, catheter changes, and catheter irrigation	Y
Bonding/ attachment	A mutual, positive relationship between two people such as a parent/caregiver and an infant/child	Y
Cardiac care	Activities that promote cardiac or circulatory function such as energy conservation and fluid balance	Y
Caretaking/ parenting skills	Activities such as feeding, bathing, discipline, nurturing, and stimulation provided to a dependent child or adult	Y
Communication	Exchange of verbal or nonverbal information between the individual/family/community and others	Y
Continuity of care	Communication of information among providers/organizations to provide safe and effective care and decrease duplication of efforts/services	Y
Coping skills	Ability to effectively manage challenges and changes such as illness, disability, loss of income, birth of a child, or death of a family member	Y
Dietary management	Nourishment with balanced food and fluids that sustain life, provide energy, and promote growth and health	Y
Dressing change/ wound care	Activities that promote wound healing and prevent infection such as observing, measuring cleaning, irrigating, and/or covering a wound, lesion, or incision	Y
End-of-life care	Activities that provide physical comfort and emotional calm for those who are dying by involving/ including family, friends, spiritual concerns, rituals, pain control, and physical care	Y
Environment	Physical surroundings, conditions, or influences in the residence, neighborhood, and/or community	Y
Exercise	Therapeutic physical activities such as active/passive range of motion, isometrics, stretching, and weight lifting	Y
Family planning care	Activities that support consideration and use of methods to prepare for and space pregnancy	Y
Finances	Management of income and expenses	Y
Gait training	Systematic activities that promote walking with or without assistive devices	Y

Target	Definition	Used
Growth/ development care	Activities that promote progressive maturation in relation to age such as measuring weight, height circumference and stimulating achievement of developmental milestones	Y
Home	Place of residence	Y
Interaction	Reciprocal action or influence among people including parent-child, parent-teacher, and nurse-client	Y
Medical/ dental care	Assessment/diagnosis and treatment provided by physicians, dentists, and their staff or assistants	N
Nursing care	Assessment/diagnosis and treatment provided by nurses and their staff or assistants	N
Nutritionist care	Assessment/diagnosis and treatment provided by nutritionists/registered dieticians and their staff or assistants	Y
Occupational therapy care	Assessment/diagnosis and treatment provided by occupational therapists and their staff or assistants	Y
Other community resources	Organizations or groups that offer goods or services not specifically identified in other targets such as exercise facilities, food pantries/distribution centers, or faith communities	Y
Personal Hygiene	Individuals' grooming activities such as bathing, shampooing, and toileting	Y
Physical therapy care	Assessment/diagnosis and treatment provided by physical therapists and their staff or assistants	Y
Recreational therapy care	Assessment/diagnosis and treatment provided by recreational therapists and their staff or assistants	Y
Relaxation/ breathing techniques	Activities that relieve muscle tension, include a quieting body response, and rebuild energy resources such as deep breathing exercise, guided imagery, meditation, and massage	Y
Respiratory care	Activities that promote respiratory or pulmonary function such as suctioning and nebulizer treatments	Y
Rest/sleep	Periodic state of quiet and degrees of consciousness	Y
Safety	Freedom from risk, the occurrence of injury, or loss	Y
Screening procedures	Evaluation strategies used to identify risk for conditions, diagnose disease early, and monitor change/progression over time	Y
Sickness/ injury care	Activities in response to illness or accidents such as first aid and temperature taking	Y
Signs/ symptoms-mental/ emotional	Objective or subjective evidence of mental emotional health problems such as depression, confusion, or agitation	Y
Signs/ symptoms-	Objective or subjective evidence of physical health problems such as fever, sudden weight loss, or statement	N

Target	Definition	Used
physical	of pain	
Skin care	Activities that promote skin integrity such as application of lotion and massage	Y
Social work/ counseling care	Assessment/diagnosis and treatment provided by social workers, counselors, and their staff or assistants	Y
Spiritual care	Activities that promote personal serenity and comfort and involve spiritual concerns/practices	Y
Stimulation/ nurturance	Activities that promote health physical, intellectual, and emotional development	Y
Stress management	Cognitive, emotional, and physical activities that promote healthy functioning during difficult life circumstances	Y
Substance use cessation	Activities that promote discontinuing use of harmful/addicting materials	Y
Support group	Organized sources of information and assistance such as focused classes and organizations, telephone reassurance, and reliable internet sites that address a specific topic such as parenting, alcoholism, obesity, and Alzheimer's disease	Y
Support system	Circle of family, friends, and associates that provide love, care, and assistance to promote health and manage illness	Y
Transportation	Methods of travel such as a car, bus, taxi, scooter, or cart	Y
Wellness	Practices that promote physical and mental health such as exercise, nutrition, and immunizations	Y

Note. Y: used as an IH target in this research; N: used as a non-IH target in this research (Chapter 4); and IH: integrative health.