CONTINUITY OF NURSING CARE IN HOME HEALTH AND ITS EFFECT ON HOSPITAL READMISSION: A RETROSPECTIVE ANALYSIS

By Tyler R. Colbert

A capstone project submitted to
The State University of New York at Buffalo
School of Nursing
In partial fulfillment of the requirements for the degree of Doctor of Nursing Practice

August 2018
Table of Contents

DNP Project Approval Form ........................................................................................................... 3
Acknowledgements ......................................................................................................................... 4
Abstract ........................................................................................................................................ 5
Introduction .................................................................................................................................. 6
Background and Significance .......................................................................................................... 6
Purpose and Objectives ................................................................................................................. 7
Contributions to Advanced Nursing Practice and DNP Essentials ................................................ 8
Theoretical Framework ................................................................................................................... 10
Review of the Literature ............................................................................................................... 12
Project Timeline ............................................................................................................................ 17
Methods and Design ....................................................................................................................... 17
Human Rights and Ethical Considerations .................................................................................... 21
Analysis and Results ....................................................................................................................... 21
Discussion and Conclusion ............................................................................................................ 27
References ..................................................................................................................................... 37
Demographic Data Table .............................................................................................................. 45
Appendices ..................................................................................................................................... 46
DNP Project Approval Form

This is to certify that ____________________________________________________________
(Name of Student)

succeeded in defending their project entitled:

Continuity of Nursing Care in Home Health and its impact on Hospital Readmission: A Retrospective Analysis

on __________________________, 2019.

(Date)

DNP Project Advisor (Required)

Carolyn Montgomery, PhD, ANP-C, GNP

(Signature)

Committee Member 1*

(Typed Name)

(Signature)

Committee Member 2*

(Typed Name)

(Signature)

Committee Member 3*

(Typed Name)

(Signature)

*If applicable
Acknowledgements

The author thanks Dr. Carolyn Montgomery for her invaluable guidance throughout the entirety of this project, Dr. Loralee Sessanna for her clarity and organization in administrating the research courses, and Dr. Christopher Barrick for his availability and expertise in formulating the methods used in this project. The author also expresses gratitude to staff at the VNA for their continued enthusiasm and support.
Abstract

Use of home health care (HHC) has burgeoned in recent years. This is largely a response to demographic shifts such as an aging population, rising health care costs, and the availability of technology that makes the home a more viable setting of care delivery (Landers et al., 2016). Investment in HHC has also grown, as expenditure on HHC is expected to exceed $150 billion by 2021 (Parker, Zimmerman, Rodriguez, & Lee, 2014). Two major indicators of care quality are 30-day acute hospital readmissions (AHRs) and nursing care continuity (CC), and sources in the literature indicate a connection between the level of CC and this clinical outcome (David & Kim, 2018). It is the purpose of this project to examine any relationship between these two quality indicators. The theoretical framework applied in this project is King’s Theory of Goal Attainment, which examines the interactions at three systems levels in order to guide care improvement and promote patient health (King, 1992). A retrospective study design was used in this project, and charts at a local HHC agency were reviewed to determine levels of CC for a high-risk patient sample. The comparative risk of AHRs for patients with varying levels of CC was done using binary logistic regression. Results of the project include a significantly reduced odds of readmission as COCI increased by increments of 0.1 (aOR=3.02 95% CI=1.016-8.97, p=.047). Neither continuity groups nor demographic variables had a significant effect, however. This initial research serves to validate continuity as a crucial quality measure.

Keywords: Continuity of Care, Home Health, Home Care, Readmissions, Re-hospitalization, High-Risk
Health care systems in the U.S. have endured seismic shifts in recent years, attributable to challenges such as more elderly patients and more narrow budgets with which to serve them (Shang, Ma, Poghosyan, Dowding, & Stone, 2014). A resulting trend is the expansion of home health care (HHC). HHC is any health service rendered in a patient home, and is a rapidly expanding realm of health care; HHC use has increased by 40% in the last two decades, delivering care to roughly 12 million patients (Lohman, Scherer, Whiteman, Greenberg, & Bruce, 2017; Shang et al., 2014). From 2001 to 2014, Medicare expenditure on HHC doubled to $18 billion (Grabowski, 2017). HHC can preserve patient dignity and independence at home, and prevent many negative clinical outcomes (Maliakkal & Sun, 2014; Shang et al., 2014).

To ensure HHC is able to address these challenges several quality indicators have emerged, such as rates of 30-day acute hospital readmission (AHRs) (Maliakkal & Sun, 2014). In fact, the annual cost of AHRs is estimated to be over $42 billion, and each single occurrence carries a cost of roughly $10,000 (Barrett, Wier, Jiang, & Steiner, 2015; Hudali, Robinson, & Bhattarai, 2017). Another method of assessing HHC quality that has gained attention is care continuity (CC) (Russell & Bowles, 2016). CC in HHC is the consistency of nursing personnel during the care episode, and though there is a relative dearth of data on CC in HHC, sources that do address CC emphasize its integral role as a measure of care quality (Gjevjon, Eika, Romøren, & Landmark, 2014; Irani, Hirschman, Cacchione, & Bowles, 2018). Therefore, this project will explore the clinical significance of CC as a HHC quality measure and its impact on outcomes.

**Background and Significance**

The emphasis on CC in HHC is based on two notions of ideal care. First, that a decrease in care fragmentation will increase clinician-client familiarity, which will in turn improve outcomes (Gjevjon et al., 2014). Second, that more coherent care promotes patient satisfaction
CONTINUITY IN HOME HEALTH CARE

(Russell & Bowles, 2016). To address challenges such as AHRs, HHC administrators must manage their resources efficiently (Wang et al., 2017). AHRs will be analyzed in this project due to their systemic significance. As many as 70% of AHRs are preventable, and the penalties hospitals face for them have exceeded $1 billion (Desai et al., 2016; Kripalani, Theobald, Anctil, & Vasilevskis, 2014). HHC’s role in preventing AHRs is critical; they assess patients regularly at home and educate them on basic health concepts, tasks more effectively done with consistency (Russell & Bowles, 2016). For HHC agencies to succeed all methods of improving care must be used, including analysis of CC to ensure a smooth, coordinated provision of care.

An established method of quantifying CC developed by Bice and Boxerman (1977) has been used extensively in the literature (Russell & Bowles, 2016). The measure, the Continuity of Care Index (COCI), examines CC in terms of dispersion and integrates the number of clinicians a patient sees, the total number of patient visits, and the number of visits from each clinician to generate a continuity score from zero to one (Bice & Boxerman, 1977). It has been used as an index of CC in a plethora of settings such as primary/specialty clinics, ambulatory centers, and inpatient facilities (Hussey et al., 2014; Romaine, Haber, Wensky, & McCall, 2014; Russell & Bowles, 2016). The purpose of this project is to explore the effect of CC on AHRs in HHC.

**Purpose and Objectives**

The purpose of the current project is to analyze the effect of CC on AHRs among patients at a HHC agency to verify the importance of CC as a quality indicator. Data will be reviewed for any significant relationship between levels of CC and AHRs. The site sample was selected to assess the levels of CC in patients receiving HHC services, and our outcomes measure was selected for its crucial role in both health care quality and cost (Shin et al., 2014). Identifying a correlation between CC and AHRs will allow HHC agencies to reinforce their efforts to provide
streamlined and effective care, while bolstering their agency ratings and patient experience, and avoiding costly penalties (Russell & Bowles, 2016). This may pave the way for further research, such as examining the role of CC in improving patient experience, patient self-management, cost effectiveness, and other outcomes (Shin et al., 2014). It is the aim of this study to evaluate CC in a high-risk (HR) HHC patient sample at the HHC site and analyze the relationship between CC and AHRs with the end goal of improving patient care.

The objectives of this project are fourfold. First, the project will distill the best evidence regarding CC and its impact on outcomes. The project will then demonstrate the feasibility of quantifying CC in HHC. By examining the data for a relationship between CC and AHRs, the project will determine the role of CC as a HHC quality measure. Finally, project findings will be disseminated to HHC staff providing the data and momentum necessary to help catalyze further research, policy reform, and improved care. The project was designed for stakeholders at the clinical site; nurses, executives, support staff, and patients/families form the main intended audience. The wider health care community such as local hospitals, insurance providers, outpatient clinics, and other health care personnel also have a stake in the improvement of HHC quality (Russell & Bowles, 2016; Shin et al., 2014). The project will be conducted at the Visiting Nursing Association of Western New York, Erie County (VNA-Erie) using data from four nursing teams. As the economy of care remains a focal point of health care policy decision-making, all methods to strike a balance between cost containment and quality improvement must be evaluated. Care continuity is one promising strategy.

**Contributions to Advanced Nursing Practice and DNP Essentials Addressed**

This project makes many contributions to advanced nursing practice (ANP), and epitomizes some of the Essentials of Doctoral Education for Advanced Nursing Practice (DNP
CONTINUITY IN HOME HEALTH CARE

Essentials) advocated by the American Association of Colleges of Nursing (AACN) (Brown & Crabtree, 2013; Moran, Burson, & Conrad, 2016). A requisite for HHC is supervision of the patient by a primary care provider (PCP) (Irani et al., 2018). Many are concerned about a shortage of PCPs, and one solution is use of APNs to fill this role (Graves et al., 2016). If the patients of primary care APNs receive HHC, all parties benefit from improved care delivery (Pollack et al., 2016). DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking affirms this commitment to coordination across settings (Moran et al., 2016). Patient-centered care is always a cornerstone of nursing practice as well, and a way to ensure this type of care is to promote CC (Romaire et al., 2014). Advocating consistent improvement of CC in HHC advances the goal of patient-centered care, and is echoed by DNP Essential V: Health Care Policy for Advocacy in Health Care (Moran et al., 2016).

All nurses, including APNs, should be committed to evidence-based practice (EBP) (Melnyk, Gallagher-Ford, & Fineout-Overholt, 2014). This project of CC in HHC represents EBP competencies described by Melnyk et al. (2014), including some specific to ANP. Those relevant to this study include descriptions of clinical problems using internal data, synthesis of internal data/external evidence for policy change, APN leadership of interdisciplinary teams, and generation of best policies (Melnyk et al., 2014). Improvement of ANP through the EBP process aligns with DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice (Moran et al., 2016). As a basic principle in providing CC is the prevention of complications through organizational reform, DNP Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health supports this project as well (Gjevjon et al., 2014; Moran et al., 2016). All of the aforementioned essentials promote the rigorous clinical scholarship and policy advocacy embodied in this project proposal (Moran et al., 2016).
Theoretical Framework

In selecting a theoretical framework to guide this project, a number of criteria were applied to identify a suitable theory. The ideal framework would be conducive to guiding quality improvement initiatives to raise the standard of patient care, as well as capable of integrating data gained from the study to draw conclusions about HHC provision and improving outcomes (Imenda, 2014; King, 1992). Integrating concepts addressed in the literature of CC, such as clinician-patient communication, shared decision-making, and health care organizational structures should also be well adapted by the theory (Bayliss et al., 2015; King, 1992). Finally, a systems-focused framework that could accommodate complex interactions in a large and dynamic care setting like HHC in a conceptually rich way was preferable, as was the ability to make predictions based on these evidence-based conceptualizations (King, 1992).

The theoretical framework that emerged to guide the project of CC in HHC is King’s Theory of Goal Attainment. The purpose of the theory is to comprehend, formally conceptualize, and delineate transactions affecting health among individuals, groups, or society as a whole (King, 1992). Among the theory assumptions is the assertion that human beings are goal-oriented, and have continuous interactions with other people, groups, and their environment (King, 1992; McQueen, Cockroft, & Mullins, 2017). King’s theory also assumes that one of a person’s primary motivations is attainment of their goals, and the theory describes the processes by which these goals are sought (King, 1992; McQueen et al., 2017). The three systems levels described in King’s theory are the individual/personal system, the group/interpersonal system, and the society/social system (King, 1992). King’s theory was influenced by general systems theory, which asserts the importance of examining components’ interactions and functions in the larger system rather than in isolation (King, 1992).
King defines concepts as abstractions generated and categorized by theorists and researchers to represent real world phenomena (King, 1992). These abstractions aid in the processes of hypothesis generation and testing and nursing knowledge accumulation (King, 1992). King’s theory assumes that certain concepts are integral to interactions had at each level (McQueen et al., 2017). At the personal systems level, the most consequential concepts are perception, self, growth/development, body image, space, and time (King, 1992; McQueen et al., 2017). Interpersonal level concepts include interaction, communication, transaction, role, and stress (King, 1992; McQueen et al., 2017). Social level concepts emphasized by the theory are organizations, authority, power, status, and decision-making (King, 1992; McQueen et al., 2017).

Numerous features of King’s theory compliment the current project of CC in HHC. The systems focus of the theory lends itself to analysis of phenomena such as CC (King, 1992). A systems approach is essential to understanding the interplay of the component parts in HHC in order to make organizational adjustments more conducive to quality care, as represented in the social systems level (King, 1992). The theory also emphasizes effective communication and information gathering at the interpersonal level, a crucial function of the nurse to establish and achieve mutual goals (King, 1992). King’s framework also supports the notion that increased familiarity with patient concerns and preferences enable nurses to positively impact care, empower patients through shared decision-making, and help patients adapt to changes at all levels of interactions, exerting a protective and stabilizing effect that will improve outcomes (Kao, Tseng, Ng, & Wu, 2019; King, 1992). This protective effect of CC demonstrates that it operates at the nexus of the three systems levels, promoting self and perception at the personal level by enhanced communication and transaction at the interpersonal level, and improved organization at the social system level (King, 1992).
Review of the Literature

Literature Review Process

To explore the state of knowledge of CC and resultant outcomes, a series of exhaustive database and manual searches were conducted to identify any relevant and rigorous studies to enrich the current project. The literature review was done in three phases. First, an initial scoping review was done to assess the level of evidence available, to refine the research question and review protocol, and to inform methods to be used in this project (Holly, Salmond, & Saimbert, 2016). The scoping review also provided resources to use in constructing the topic background and subsequent proposal sections. Second, a formal review of the literature was performed within following bibliographic databases: CINAHL, PubMed, the Cochrane Controlled Register of Trials (CENTRAL), and Embase. Basic limiters were applied to searches in each database to filter irrelevant results and return an accessible number of sources. These included sources published from 2014 to present (with the exception of one seminal article), English language only, adult patient samples only, and articles addressing CC and readmissions. Study designs retrieved were limited to those using randomized controlled methods, quasi-experimental studies, case-control/cohort studies, and observational studies. Keywords used to guide the searches in each database included varying combinations and synonyms for the main project variables such as “continuity of care” or “care continuity,” and “readmission” or “rehospitalization,” and “home health” or “home care.” Iterations of the searches in each databases continued until results became repetitive and saturation was achieved.

The final phase of the search strategy involved manual searches through ancestry/descendancy searches of relevant seminal literature, specific journals or professional association websites likely to contain useful references, and the grey literature to identify
unpublished sources (Polit & Beck, 2017). Manual search references were filtered and limited using the same criteria as those from databases. The article used for descendancy searches was the article that introduced the COCI by Bice and Boxerman (1977). The total number of articles retained following the searches was 76, and 69 after duplicates were removed. Article titles and abstracts were then screened for their relevance and rigor (Appendix A). The full texts of 21 articles were then critically appraised for value to the current project. Articles were appraised using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool, a six-item instrument to evaluate quantitative studies (Kumar, Kroon, & Laloo, 2014). After appraisal, 14 articles were excluded for the following reasons: two articles for alternative intervention, four for alternative outcomes, four for alternative population, and four for a lack of rigor (Appendix A). A final set of seven articles were retained for literature review data synthesis.

**Literature Review Synthesis**

Seven methodologically sound and relevant studies were retained after the critical appraisal process to form the foundation of the review synthesis. Most of the studies were retrospective given the nature of CC; the articles by Bayliss et al. (2015), Swanson, Vogt, Sundmacher, Hagen, and Moger (2018), Kao et al. (2019), Mondor et al. (2017), David and Kim (2018), and Russell, Rosati, Rosenfield, and Marren (2011) all used retrospective methods. The exception to this was the study by Popejoy et al. (2015), which had a quasi-experimental time series design. Results on the effects of CC on readmissions will be divided into three categories: continuity in primary care, in ambulatory care, and in home health care.

**Continuity in primary care.**

The first category of studies were those measuring primary care provider CC using COCI and correlating the levels observed with rates of admissions/readmissions among the patient
samples. These articles include those by Bayliss et al. (2015) and Swanson et al. (2018). Both of these studies were large retrospective studies; the studies had a combined 32,100 patients from Norway, Germany, and the United States (Bayliss et al., 2015; Swanson et al., 2018). In each study a modest but statistically significant negative correlation between CC and admission/readmission was observed. In the study by Bayliss et al. (2015), greater CC in primary/specialty clinics were found to have statistically significant effects: each 0.1 increase in COCI was correlated with a decrease in hospital admission risk of 2-3% (p<.05) among their patients. This finding is corroborated by Swanson et al. (2018), who reported more marked findings: for every 0.1 increase in COCI one year post-discharge, readmission risk was reduced by 14.5% (p<.001). Also of note, Swanson et al. (2018) included among their limitations the uncaptured and potentially significant effects of nursing CC in home care and its effects on important quality indicators, like readmissions, given the recent expansion of the HHC sector.

**Continuity in ambulatory care.**

The second category consists of studies evaluating COCI in ambulatory care settings and correlating this measure with readmission. Kao et al. (2019) and Mondor et al. (2017) both investigated the role of CC in large samples of patients seeking ambulatory care with a total sample size of 31,523 elderly patients living in Taiwan or Ontario. In the study by Kao et al. (2019), patients with COPD/asthma were partitioned into groups based on COCI levels deemed to be low (<0.3), moderate (0.3-.99), or high (1). The risks of hospital admission for disease exacerbation were then calculated as hazard ratios (HRs), and patients with low or moderate COCI were found to have HRs of 2.80 and 2.69 (p<.01) compared to patients in the high COCI group (Kao et al., 2019). In the analysis by Mondor et al. (2017), low COCI was correlated with
an 11% increased risk of hospital admission initially (HR=1.11, p<.001), but this effect did not maintain statistical significance when adjustments for age and gender were included.

**Continuity in home health care.**

The three remaining articles by Popejoy et al. (2015), David and Kim (2018), and the seminal article by Russell et al. (2011) form the third category of studies which address CC specifically in the context of HHC. First among the notable studies come from Popejoy et al. (2015), in which an intervention to increase care coordination called the Aging in Place (AIP) program was tested among an experimental HHC patient group and compared to the usual care control group. The intervention aimed to reduce care utilization costs in the 213 community-dwelling seniors that formed the AIP group, while 585 control patients received standard care (Popejoy et al., 2015). Among the results of the study was a statistically significant reduction in readmissions in the AIP group by roughly 0.5 events per year (p<.05). Although this study did not formally measure CC, their care coordination program would have raised CC, and concurrently demonstrated improvement in readmissions (Popejoy et al., 2015).

The article by David and Kim (2018) was an analysis of HHC nursing discontinuity as measured by “handoffs” and its effect on the rate of hospital readmissions. The study used a retrospective case-control design involving review of data from 43,470 HHC episodes comprising over one million patient-days (David and Kim, 2018). The authors operationalize handoffs as the series of days after an unfamiliar nurse visits a patient and ending when the same nurse returns (denoting the “handoff state”) (David and Kim, 2018). Among the most notable results the authors discovered was the fact that a single nursing handoff in HHC increased the risk of a hospital readmission by 24% (p<.01) (David and Kim, 2018). Also significant is the
fact that handoffs reduced the amount of time between a nurse visit and a readmission by 9% (p<.01) (David and Kim, 2018).

The final article is a seminal article heavily referenced in the literature by Russell et al. (2011). This was a large retrospective study conducted on a sample of 59,854 patients receiving care from a large urban HHC agency (Russell et al., 2011). Authors were concerned with outcomes of hospitalization, emergency room (ER) visits, and improvement in Outcomes and Assessment Information Set (OASIS) records used to measure patient functional status (Russell et al., 2011). COCI was the measurement used to quantify CC in this study, and patients were divided into groups representing low (0.00-0.39), moderate (0.40-0.79), and high (0.80-1.00) CC subgroups (Russell et al., 2011). The investigators found significant differences between groups in all of their measured outcomes. Results from Russell et al. (2011) authenticate those from David and Kim (2018), Bayliss et al. (2015), Swanson et al. (2018), and Kao et al. (2019). Such results included the finding that patients in the low and moderate COCI groups were 43% and 13% more likely to be hospitalized than their high COCI counterparts, respectively (p<.001) (Russell et al., 2011). Further solidifying the protective effects of sustained CC in HHC, the low COCI group was 33% (p<.001) more likely to visit the ER and 20% (p<.001) less likely to see improvement in OASIS measures than the high COCI patient group (Russell et al., 2011).

The results of these articles produce two conclusions. First, these studies expose a substantial gap in the literature regarding the connection between the important care quality indicator of CC and the outcome of AHRs in HHC. Second, the studies that do exist firmly establish the importance of CC in promoting optimal outcomes in health care generally and in HHC specifically. However, more research should be done to explore the significance of CC.
**Project Timeline**

This Doctorate of Nursing Practice (DNP) Capstone Project was completed over the course of two semesters, in the spring and summer of 2019, with guidance provided by the DNP Project Team members. Activities of the first semester included completion of the DNP project proposal paper and defense, as well as submission of the research protocol and supplemental materials to the University at Buffalo (UB) institutional review board (IRB) for review, input, clarification, and approval. Continual revision of the project took place throughout these semesters, and a Gantt chart showing project progression can be found in Appendix E.

**Project Methods and Design**

**Setting**

This study took place at VNA-Erie, which is a large non-profit HHC agency serving the Buffalo metropolitan area and surrounding counties. Patients are seen by a nurse at the start of care (SOC) visit following discharge from inpatient care (or physician referral), and the SOC visit determines their clinical needs, as well as their risk status for hospital readmission. VNA-Erie has several nursing teams assigned to patient populations based on geographic area or clinical specialty. Most teams at VNA-Erie are medical-surgical, although there are specialized nurses on the behavioral health, infusion, and pediatric teams. Medical-surgical teams generally have a census of 200-300 patients per team at one time, approximately 7-10% of whom are HR patients (L. Greisler, personal communication, February 22, 2019). The current method of CC calculation at VNA-Erie is a simple measure of how many nurses a client sees during their 60-day care episode, in contrast to the COCI measure that was used in this study (L. Greisler, personal communication, February 22, 2019; P. Orcutt, personal communication, March 24, 2019). The necessary VNA-Erie records were either provided directly by a VNA data analyst (in
the case of readmissions data) or were retrieved by the principal investigator (PI) using enhanced access provided by the VNA. Data extraction only occurred within the VNA-Erie EHR system to prevent any potential compromise of patient data. Data was only retained in de-identified form to ensure full confidentiality of patient information.

**Sampling Procedures**

Sampling procedures for this study endeavored to ensure homogeneity of the sample to limit the influence of potential confounders (age, diagnoses, etc.) and isolate the effects of CC alone on AHRs as much as possible (Polit & Beck, 2017). To that end, only the population of HR patients were examined. The determination of HR patient status at VNA-Erie is made by criteria in OASIS item M1033, as well as analytics services from an outside consultant (Appendix B) (CMS, 2018; P. Orcutt, personal communication, March 24, 2019). Criteria in M1033 include multiple hospitalizations/ER visits in the prior six months, polypharmacy (5+ medications), history of falls, and other items elucidated in Appendix B (CMS, 2018). Further patient eligibility criteria for this study included adult patients only (18+), those who have received three or more nursing visits from VNA-Erie nurses (RN or LPN), and patients admitted to one of the four selected medical-surgical teams within the 2018 calendar year. Patients may have received services at any point between 01/01/2018 to 12/31/18 provided they met the other criteria as well. Any patients not satisfying all of these criteria were excluded. No pediatric patient populations, or visits from other disciplines such as physical or occupational therapy, social work, etc., were included in the analysis. Demographic covariates that were obtained from this sample include: age, gender, race/ethnicity, primary diagnosis, payer source, living arrangement, and the number of visits/length of stay (NOV). A simple random sample of HR
patients admitted to the four nursing teams in 2018 was drawn from the sampling frame until the entirety of eligible cases (N=62) were retrieved (Polit & Beck, 2017).

**Data Collection**

The VNA-Erie records were used to retrieve all demographic, continuity, and readmissions data which was then used to generate descriptive and inferential statistical data. In addition to the aforementioned demographic data, the COCI measure and VNA-Erie patient visit histories for the HR patient sample were used to calculate a COCI score for each patient. The COCI measure was originally developed by Bice and Boxerman (1977), which itself is based on previous work conceptualizing continuity and social fragmentation (Shortell, 1976; Taylor & Rae; 1969). The intent for the development of COCI was to operationalize CC and offer a statistical instrument for its calculation (Bice & Boxerman, 1977). As previously mentioned, it has seen wide application in the literature, as studies examining diverse health care interactions and contexts have used the COCI (Bayliss et al., 2015; Kao et al., 2019; Russell et al., 2011).

At the VNA-Erie, a COCI score was calculated easily as the record for each patient contains the total number of visits, the clinician who provided services and their credentials, and the total number of different clinicians each patient interacted with. This is all that is required to calculate COCI for the HR patient sample (equation shown in Appendix C) (Bice & Boxerman, 1977). Only live nursing visits recorded in Homecare Homebase, the electronic health record (EHR) used at VNA-Erie, were counted. Each nursing visit at the agency has a distinct service code attached to it, such as RN00 for a SOC visit or RN15 for a resumption of care (ROC) visit, both of which are live visits. In contrast, an RN44 for example, or transfer to inpatient facility (TIF), is not a live visit and was not counted. Further, there are sometimes multiple service codes intended for the same patient on the same day. In such instances, this was only recorded
as one visit. All patient data was retrieved at the VNA-Erie office, a badge-access facility. All cases were reviewed to ensure adherence to eligibility criteria to finalize the sample.

AHRs are recorded as a claims-based outcomes measure, allowing for simple collection from the VNA EHR system and dichotomous coding of this variable for each patient (CMS, 2019). The desired sample size for this study was 400 HR patients across the four nursing teams, however this sample size was not achieved. The PI was given re-hospitalization records for all patients in 2018, regardless of risk status by VNA-Erie analysts. These records were then reviewed to remove all non-HR patients and further confirm eligibility. An initial sample of 105 patients was retained as being HR, and 73 after duplicates were removed. A further two patients were excluded due to having insufficient visits (less than three). Nine of the patients had missing data from the readmissions records, and listwise deletion was used in these cases. It was determined that variable deletion would be imprudent as it was the outcome variable, nor would it be conducive to any form of imputation due to its binary nature. This brought the final project sample to 62 HR adult patients at VNA-Erie in 2018.

To maintain privacy and compliance with the Health Insurance Portability and Accountability Act (HIPAA), all patient data was de-identified using a randomly generated 5-digit patient case number (PCN) thereafter serving as identification only for study purposes, and then was transferred to Microsoft Excel on the password-protected computer of the PI. Data will be retained for three years after study completion and then destroyed in accordance with Institutional Review Board (IRB) stipulations. The data was stored in the private home office of the PI to perform data analysis. This retrospective study did not require informed consent and thus no dedicated research repository was used.
Human Rights Protection and Ethical Considerations

To conduct this study in an ethically sensitive manner, several methodological strategies were adopted. These measures were intended to preserve the integrity of the fundamental rights of all patients: beneficence, human dignity, and justice (Miracle, 2016). The retrospective design of this study alleviates some concern regarding threats to patient rights, such as exploitation, fair treatment, and coercion (Polit & Beck, 2017). For instance, there will be no direct contact between the PI and sample patients. Further concerns such as privacy and confidentiality are addressed by the de-identification of patient data, secure storage of all data elements, and randomized sample selection, preventing any preferential or otherwise non-systematic methods of sampling. True to the broad applicability of CC, the sampling frame includes a diverse population of patients including women, minorities, varied diagnoses and socioeconomic status, and others (Polit & Beck, 2017). The study also has a favorable risk/benefit ratio, as results of this study may bolster efforts to improve HHC quality. Further, the risk posed by this study is minimal and largely concerns the maintenance of confidentiality, which will be assured using the aforementioned strategies. As this project is being conducted as fulfillment of a curriculum requirement for the Doctorate of Nursing Practice (DNP) program, there is no possibility of financial gain on the part of the PI and thus there are no conflict of interest concerns to report. After study completion, the study results will be submitted to VNA-Erie in the form of an executive summary.

Analysis and Results

Data analysis for all the demographic, continuity, and readmissions variables was performed in IBM SPSS version 25. As previously stated, a final sample of 62 patients at the VNA-Erie was analyzed after confirming that the eligibility criteria (three or more visits, seen in
2018, etc.) was satisfied. Various methods of data cleaning were performed, such as searches for outliers, wild codes, ensuring patients met eligibility criteria, or further missing data. One outlier was noted in the COCI measure; a patient was recorded as having a perfect (1.00) COCI score. However after review of the patient’s chart and the manual calculations, it was determined that the score was legitimate and would be retained in the analysis. No further missing data was found, nor were there any wild codes present in the dataset.

Statistical analysis was performed following finalization of the patient sample and dataset. The aforementioned demographic traits (e.g. age, race, diagnosis, etc.) of the patient sample were quantified using descriptive statistics. This was meant to establish familiarity with the sample, and generated data on pertinent characteristics of the patient sample, including frequencies, measures of central tendency and variability, and correlation (Polit, 2010). Age was defined as the patient’s age in years at the date of data extraction, and gender was categorized as male or female. Race was coded as black, white, Asian, Latino, Pacific Islander, or other. For diagnoses, the most prevalent diagnoses in HHC and those at higher risk of readmission were included (Kripalani, Theobald, Anctil, & Vasilevskis, 2014; Rubin, Donnell-Johnson, Jhingan, Golden, & Paranjape, 2014). Diagnoses were categorized based on the primary diagnoses listed in the health record for each sample patient, and were coded as cardiac disease, diabetes mellitus, pulmonary disease, renal disease, dementia, cancer, skin breakdown, or other. Number of visits were defined as live visits provided during the project timeframe (2018), and provided by a nurse (RN or LPN).

For each patient a COCI score between zero and one was calculated. Depending on the resulting COCI score, each patient was to be then assigned to the low continuity (LC), moderate continuity (MC), or high continuity (HC) group. Low continuity was defined as a COCI
between 0.00 and 0.29; moderate continuity as a COCI between 0.30-0.69; high continuity as a COCI between 0.70-1.00. It became apparent during analysis however, that it would be necessary to merge the MC and HC groups. Both MC and HC groups combined only comprised 11.3% of the sample, and only one of these patients was in the HC group. Further, the calculation of odds ratios requires a non-zero value in each cell of the basic cross-tabulation matrix (Andrade, 2015; Polit, 2010). Thus these two groups were merged to form a new group with moderate-high continuity (MHC, COCI 0.30-1.00). The outcome of interest, 30-day AHRs, was calculated for each group as well, and both simultaneous and sequential binary logistic regression was performed to control for confounders and assess the relationship between the predictors in the model and the dependent variable. Adjusted odds ratios (aORs) were then calculated to determine the comparative levels of risk for AHRs faced by patients in the LC and MHC groups.

Sample Characteristics

As far as the gender distribution in the sample, 37.1% were male and 62.9% female. There was also relatively proportional representation of genders within the LC and MHC groups: the majority of both men (91.3%) and women (87.2%) were in the LC group, with the remainder of each (8.7% and 12.8%, respectively) in the MHC group. The sample was also fairly diverse in terms of racial composition. Patients who were white comprised 45.2% of the sample, with patients who were black or Latino contributing another 40.3% and 4.8%, respectively. The remaining 9.8% were labeled as other.

There was broad distribution of primary diagnoses as well. In the sample, cardiac disease, diabetes, and pulmonary disease each comprised 9.7% of the patients. The diagnoses of cancer and skin breakdown were most common, as each accounted for 17.7%. Finally, renal
disease was the primary diagnosis in 12.9% of patients and diagnoses otherwise unspecified in the project comprised the remaining 22.6% of patients. There was relatively little variation in the payer source for the sample patients; 46.8% of patients received their care through managed Medicare, 17.7% through managed Medicaid, and the remaining 35.5% through traditional fee-for-service Medicare. Regarding living arrangement, the majority of patients lived with others in the home (71.0%). However, 25.8% and 3.2% lived either alone or in a congregate living facility (e.g. assisted living), in that order. Further description of demographic variables can be found in Table 1.

Characteristics of the interval/ratio data (Age, NOV, and COCI) such as skewness and kurtosis, as well as the overall level of the normality of the distributions, were also analyzed. This was done to ensure the data met underlying assumptions of the intended statistical tests that if violated, may render results unreliable or difficult to interpret. Of the scale variables, only age presented with a normal distribution based on the Kolmogorov-Smirnov test (p=.200). The average age in years of patients was 68.7, or 67.8 and 75.7 for both the LC and MHC groups, respectively. Age was found to be negatively skewed (skewness index=-.58) and moderately leptokurtic as well (kurtosis index=.27).

**Number of Visits and Continuity of Care Index**

The average NOV in the LC and MHC groups were 53 and 31, respectively, however the Mann-Whitney U test determined that this difference was not statistically significant (p>.05). The NOV varied among the readmitted and non-readmitted patients as well: readmitted patients had a mean NOV of 28 while non-readmitted patients had 36, though this result, according to the Mann-Whitney U test, did not achieve statistical significance either (p=.95). The COCI scores were similar to NOV in their markedly positive skew (skewness index=.30), and was leptokurtic
as well (kurtosis index=16.1), indicating a relatively low degree of variability and COCI scores tending to cluster around the lower end of the scale. This is seen in the absolute frequencies of COCI scores as well. As previously mentioned, a full 88.7% of patients had a COCI score below 0.30. In terms of the continuity groups, the mean COCI scores of the LC and MHC groups were 0.14 and .44, respectively. Among the more interesting results of the descriptive analysis was the difference in COCI scores themselves among the patients who had a 30-day AHR relative to those that did not. The mean COCI score for the readmitted group was .14, as compared to .19 in the non-readmitted group. Though it should be noted that this too was deemed to be a statistically non-significant difference after the Mann-Whitney U test was done (p=.14). The distribution of COCI variables is presented graphically in Appendix D.

Acute Hospital Readmissions

Of the 62 patients in the sample, 20 (32.3%) experienced a 30-day AHR while the remaining 42 (67.7%) did not. These readmissions were not evenly distributed among the LC and MHC groups. Of those readmitted within 30 days, only 5% (one patient) was from the MHC group and the remaining 95% (19 patients) were from the LC group. The majority (85.7%) of MHC patients were not readmitted, while non-readmitted LC group patients accounted for 65.5% of the total within that group. Based on this data, the calculated odds ratio (OR) for 30-day AHRs among LC group patients compared to their MHC counterparts is OR=3.17 (95% CI=0.36-28.26), indicating at face value that the odds of being readmitted was increased threefold for LC patients above the risk associated with the MHC group. However, it should be noted that this initial risk index did not reach statistical significance (p=.30) (Polit, 2010; Shisken, 2004). Thus, both a simultaneous and a sequential binary logistic regression model was generated to more finely examine the impact continuity may have had on 30-day AHRs in this
sample, to apply statistical control to the other covariates, and to determine if any results could be applied to a broader population of HR HHC patients.

**Simultaneous and Sequential Logistic Regression Analysis**

Based on convention, it is considered prudent that when performing logistic regression a minimum of 10-20 patient cases per predictor should be used (Polit, 2010). Therefore, not all demographic variables were included in either the simultaneous or the sequential models. The decision was made to exclude living arrangement, ethnicity, and payer source in the initial models. The covariates included in the first simultaneous model were all entered within the same block: age, NOV, COCI score, gender, race, diagnosis, and finally continuity group status (LC or MHC), with the excluded covariates to be run in a second simultaneous model. Based on the results of the simultaneous binary logistic regression model, the aOR of 30-day AHR for LC compared to MHC patients in this sample was 2.45 (95% CI=0.17-34.83) with a Wald statistic (a commonly used test of significance in logistic regression) of .44. The Nagelkerke $R^2$, a measure of overall effect size of the logistic model, was .25 for the simultaneous regression. However, group membership’s effect on AHR status was not found to be statistically significant either (p=.51), and nor were any of the other covariates in the either simultaneous model significant.

A different result was observed when a sequential regression model was used instead, and when an additional variable was entered. The additional variable was an incremental version of the COCI scores, where patients were assigned to equal tiers each corresponding to one-tenth of the total range of COCI scores. This was originally done to perform a logit step test, which will be described later. Data was entered into the model in three successive blocks to establish control over potentially confounding variables first and to note changes in effect size for instance, from block to block as more predictors are added (Polit, 2010). The demographic
variables (age, gender, race, diagnoses, and NOV) were entered in the first block. Continuity

group status (LC and MHC) were entered in the second block. In the third block, the new

incremental COCI variable was entered and the regression analysis commenced. For this new

variable, the aOR=3.02 (95% CI=1.02-8.97) and a Wald statistic of 3.95 (p=.047).

Discussion and Conclusion

The sample in this study, despite its modest size, exhibited many similarities to HHC

patients seen in other large studies in the literature and appeared to illuminate the connection

between continuity and readmissions. The general characteristics of the sample will be

compared to those of larger studies in the literature, as well as notable differences in results,

conclusions that may be drawn from the analysis, limitations and strengths of this project, and

promising future directions for further research.

As noted, the mean age of the patients in this sample was 68.7 years, and similar age
distributions with mean ages from 70-83 years old have been presented in larger studies on care
continuity (Bayliss et al., 2015; Kao et al., 2019; Mondor et al., 2017; Russell et al., 2011). The

sample in this project also approximated traits of other larger HHC studies with regard to
diagnoses. Of the diagnosis categories examined in this project, those making up the largest

share of the sample included cardiac and pulmonary disease, cancer, renal disease, and skin
breakdown, all of which also feature prominently in the larger literature (Chiang et al., 2015;
Popejoy et al., 2015; Ronneiko et al., 2017; Russell et al., 2011). The percentage of female

patients was substantially larger than that of males, and this tendency is also seen in the samples

of many larger HHC studies (Fortisnky, Madigan, Sheehan, Tullai-McGuinness, & Kleppinger,
2014; Popejoy et al., 2015; Ronneiko et al., 2017; Russell et al., 2011). The sample was

relatively diverse in terms of race as well, perhaps due to the large geographic area for which the
VNA is responsible. The sample was more diverse than some large studies such as Fortisnky et al. (2014) and Popejoy et al. (2015), which each reported a proportion of white patients at 80% or higher, though not all studies exhibited this profile and potential source of bias (Russell et al., 2011).

Perhaps most notably, the sample in this project exhibited mean COCI scores generally below the means of other studies in the literature (Bayliss et al., 2015; Kao et al., 2019; Russell et al., 2011). For example, the average COCI scores reported in the studies by Kao et al. (2019) and Russell et al. (2011) were 0.55 and 0.54, respectively, as compared to the mean value in this project which was 0.17. This was not universal however. Bayliss et al. (2015) noted a relatively low COCI score (0.20) among the specialty care physicians they analyzed as well. Though it should be noted that most of these studies, save for that of Russell et al. (2011), were examining COCI in the context of other disciplines besides nursing, such as primary or ambulatory care physicians, and thus a direct comparison may be spurious.

As described in the results section, the simultaneous logistic regression did not produce statistically significant results for any of the predictors included except the incremental COCI variable, and probability values generally fell between .20 and .80. As previously mentioned, the Nagelkerke R² for this equation was a modest .25, which loosely represents the magnitude of the relationship between the predictors in the model and the binary outcome of readmissions (Polit, 2010). An interesting comparison was made between this measure and the pseudo-R² of the sequential regression model, however. Between the first and second blocks of the sequential model there was very little change in R² (less than 1%) and at the end of the second block, the R² was identical to its value in the simultaneous model. This is unsurprising, as up to this point the predictors in the two models were also identical. However, once the incremental COCI variable
was entered in the third block, Nagelkerke R² increased by 8% to .33. This could be taken to indicate that, with all the aforementioned variables tightly controlled, the incremental COCI variable on its own accounts for a modest but substantial portion (8%) of the variance of the probability of a 30-day AHR in this patient sample. However, it should also be noted that the difference between the -2 log of the likelihoods (-2LL, which has a distribution that approximates that of chi-square) of the null model in the regression and the full three-block sequential model did not achieve statistical significance. The model χ²=16.68, (p=.27), which represents the difference in the -2LL of the two models, and analysis of it is often called the likelihood ratio test, i.e. the ratio between the likelihood indexes of the null and full models (Polit, 2010). Therefore, based on the non-significant result in these omnibus tests, we cannot reject the null hypothesis that there is a significant relationship between the predictors collectively (the full model) and the outcomes variable of 30-day AHRs.

In terms of the individual covariates’ influence on the dependent variable, the results were largely unambiguous. The demographic predictors of age, gender, and race appeared to have no discernable effect on the outcome based on the regression model, nor did any of these approach statistical significance (p>.50 for all three). These results are similar for the patients’ primary diagnoses, number of nursing visits, and for the LC and MHC groups. There was no statistically significant associations found between these predictors and the dependent variable. The variable of continuity group status returned an aOR=.61 (95% CI=.024 – 15.299, p=.76) in the sequential model.

The exception to this trend of non-significant results is the incremental COCI variable. As previously reported, this variable returned an aOR=3.02 (95% CI 1.02-8.97). At face value, this appears to indicate that for each unit decrease of this variable (a decrease in COCI by
increments of .10) there is a commensurate threefold increase in the odds of a 30-day AHR, and this result did reach statistical significance (Wald statistic=3.95, p<.05). It is also worth noting that the effect of the incremental COCI variable held significant when it was entered either in a simultaneous model with the rest of the predictors or in the first or second blocks (as opposed to the third) of another sequential regression model as well. In both an alternative sequential and simultaneous logistic regression models consisting of age, gender, race, diagnosis, number of visits, continuity group status (LC and MHC), and incremental COCI, the adjusted odds ratios and significance levels remained the same as aOR=3.02 (95% CI=1.02-8.97, p<.05). Thus, from this initial examination of the potential of continuity to affect perennial health care outcomes, this measure appears to exert a measurable and significant effect on the risk of hospital readmission. However, further exploration of this connection should be done with a broader sample of patients to validate these results.

Limitations and Strengths

There are nonetheless a number of important limitations encountered during data collection and analysis that merit some mention. The current project is hindered by a number of limitations that if corrected, could provide insight that is more valuable and guide further inquiry into the importance of continuity in improving patient outcomes in HHC. First, a problem in this project was the modest sample size. It was estimated by VNA staff that their nursing teams have a census of approximately 200-300 patients each, and that 7-10% of these patients are high-risk. This suggests a range of 56-120 HR patients at any one time among four teams, and it was assumed that across a full year this proportion could have met the desired 300-400 sample size for the project. The final sample size of 62 was much more modest in contrast, however still allowed most of the statistical analysis that was intended at project outset. A simple post hoc
power analysis was done to evaluate the actual power behind this project. Based on the desired $\alpha$ level and the observed effect size (Cramér’s $V=0.14$ in this project), as well as the sample size ($N=62$), the power appeared to be less than $\beta=.25$. If sufficient sampling could be achieved for new LC, MC, and HC groups (i.e. a 2 x 3 table), and assuming the effect size is similar, to achieve more adequate power ($\beta=.80$) a sample size of approximately 675 patients would be necessary to mitigate the risk of a type II error (Polit, 2010). Another limitation of the present project is the use of exclusively retrospective, case-control methods and the possibility of bias it introduces. Also, the disparity in the sizes between the LC and MHC groups (and the need to merge the MC and HC groups) presents another limitation, as ideally for analysis purposes the groups would be roughly equivalent (Polit, 2010).

There are some assumptions of logistic regression analysis that should be addressed as well. Independent sampling of subjects is one assumption, which remains intact for this project; patients were selected at random only based on their satisfaction of the a priori eligibility criteria (Polit, 2010). Multicollinearity among predictor variables is another important consideration in logistic regression; if two or more covariates are co-linear, they do little to enhance the overall model (Polit, 2010). In this case, correlations among all interval/ratio variables (NOV, COCI, and age) were assessed, and Pearson’s $r$ was not found to be statistically significant between any of them. The strongest association was between age and COCI (Pearsons’ $r=.25$), however it was not significant at the .05 level ($p=.052$). Removing outliers is generally recommended in logistic regression as well, and in this case there was one outlier value for COCI (1.00) that was included in analysis. Based on the distribution for the COCI variable, it was 2.24 standard deviations above the mean. However, it was retained as it was a legitimate measure as opposed to an error code, and a cutoff of 2.58 standardized units is often suggested for outlier exclusion.
(Polit, 2010). Further, the sequential regression was re-run excluding the outlier with a modified incremental COCI and the odds ratio and probability value did not differ substantially. Finally, logistic regression also assumes linearity between the continuous predictors in the model and the log odds of the dependent variable (Polit, 2010). A logit step test was performed to assess if the \( b \) coefficients of the continuous variables in the model (age, NOV, and COCI) increased in an approximately linear fashion with the log odds of 30-day AHRs, and it was determined that they did not. Therefore the linearity assumption, which increases the risk of a type II error further, was most likely violated by the sample data (Polit, 2010). The fact that the majority of predictors, including the one theorized to have a significant effect on 30-day AHRs (continuity group status) had no statistically significant relationship can be considered a major limitation of the present project as well.

This project has strengths that should also be delineated. As previously mentioned, the project did utilize random sampling procedures which lends validity to the results when making inferences about the broader population. The study was also adapted to the more modest sample size while remaining analytically sound through the merger of the MC and HC groups. The initial exclusion of three predictors also served to maintain the stability of the parameter estimates and preserve a proper predictor-to-case ratio (Polit, 2010). Eligibility was also strictly adhered to, and ineligible patients were identified at various stages of data collection prior to analysis. Most importantly, despite numerous limitations the project appears to have still returned statistically significant results in the form of the incremental COCI variable. This result is bolstered by the fact that it was controlled through not just the original logistic regression model, but also through manipulating the order of covariate entry into the model with a simultaneous and alternate-sequence models (i.e., entering incremental COCI at blocks one or
two) and persistently significant results (p<.05). Outliers were controlled for as well, through exclusion of the main outlier in the COCI predictor to see if significant effects were still seen, which they were. Given the rigor with which the statistical procedures were performed, one can be reasonably confident in the results presented. The fact that the relatively low level of continuity was identified and was able to be compared to previous studies and prior patient groups is noteworthy in itself. It has already been remarked that previous studies’ mean COCI scores were on the order of .50, as compared to .17 in this sample (Bayliss et al., 2015; Kao et al., 2019; Russell et al., 2011). It may be thought that the higher frequency of visits in this group contributed to the dispersion of care observed; however, COCI and NOV were found to not be significantly correlated (Pearson’s r=.24, p=.057).

**Application of Theoretical Framework**

The aforementioned theoretical framework used in this study is King’s Theory of Goal Attainment, and it provides a useful lens with which to view the current project. The framework primarily concerns the transactions between people at three distinct levels: the personal/individual, interpersonal/group, and social/society levels (King, 1992). For this project, the system of interest is of course the HHC agency primarily, and secondarily the larger health care system that patients must navigate to improve their health. The theory posits that within these systems, people will engage in interactions with the foundational goal of health preservation and goal attainment (King, 1992). In our context, the goal is avoidance of hospital readmission. Through aligning the unique elements of the interpersonal and social systems (e.g. interactions and communications, or organization and decision-making, respectively) to improve the patients outcomes and health at the personal level of the patient, this this goal may be achieved. Enhanced continuity of care, and thus enhanced familiarity/rapport, is one form of
realigning these fundamental concepts in such a way as to maximize the prospects of attaining this goal (Kao et al., 2019; King, 1992).

**Conclusion**

The primary goal of this project was to collect, analyze, and present retrospective data on the topic of care continuity and any impact it may have on readmissions in the present sample. This is an opportune time to examine pivotal issues in HHC such as readmissions and continuity, as it is the most swiftly expanding domain of healthcare in the United States (Frogner, Spetz, Parente, & Oberlin, 2015; Shang, Larson, Lui, & Stone, 2015). The estimated rate of expenditure increase in HHC is even expected to outstrip the health care system at large; by 2024 it is estimated that HHC will be growing at an annual rate of 7.0%, as compared to the overall national health care expenditure which will be growing by 6.2% annually (Keehan et al., 2015). Additionally, the total expenditure on HHC in the U.S. is expected to rise to well over $150 million (Keehan et al., 2015). Given its increasing share of the health care market, it is imperative to optimize HHC. This is perhaps best represented in the case of reducing readmissions to the hospital after being discharged. As previously noted, this problem carries a heavy cost; estimates on the cost of readmissions reach as high as $42-44 billion (Barrett, Wier, Jiang, & Steiner, 2015; Hudali, Robinson, & Bhattarai, 2017; Verhaegh 2014). Estimations on the share of preventable readmissions among the total is high as well however, often as high as one third (Bates, Saria, Ohno-Machado, Shah, & Escobar, 2014). Care continuity has been advocated as a potential method to preventing these costly readmissions (Russell et al., 2011, Turner et al., 2014).

Future projects could improve on this work in a number of ways. One measure that may also provide valuable insight for HHC improvement is days to readmission, which would also
allow for new statistical approaches to be used as well (Polit, 2010). Broadening the sampling frame or using quota sampling to ensure that the desired continuity groups are roughly equal would also be constructive modifications to future research. Other alternative outcomes measures could include OASIS functional abilities, ER visits as well, and patient satisfaction scores, and these measures have some precedence in the literature as well (Kao et al., 2019; Russell & Bowles, 2016). Integrating other disciplines commonly active in HHC, such as physical or occupational therapy, into such investigations into the effect of continuity may be beneficial as well. Lastly, alternative methods of achieving the same benefits of high continuity should be explored, such as the use of telehealth to prevent readmissions (O’Connor et al., 2016).

This project makes numerous contributions to advanced practice nursing and embodies many of the DNP Essentials. First, the commitment to ensuring patients are receiving care from their HHC staff that is well coordinated and seeks to minimize care dispersion is reflective of DNP Essential V: Health Care Policy for Advocacy in Health Care (Moran et al., 2016). As was discussed alongside the theoretical framework, this project also affirms the connection between high-level organizational concerns such as resource allocation, scheduling, and other systemic matters with the personal level of the patient’s experience operating within that system. Exploring this connection and its impact on the patient is representative of the values in DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking (Moran et al., 2016). Finally, a central goal of all HHC services is to prevent further complication after a patient is discharged from inpatient care. DNP Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health confirms both the centrality of this goal and of projects such as this one to improve the health of whole patient populations through practice that is firmly evidence based.
In terms of deliverables, this project makes four primary contributions. First, the introduction of site personnel to a new measure of care dispersion (COCI) may promote more evidence-based measurement of this aspect of care (Bice & Boxerman, 1977; Russell et al., 2011). Second, based on the both the literature review and data analysis, it appears that the continuity of care in the patients examined falls considerably below those in other studies (Bayliss et al., 2015; Kao et al., 2019; Russell et al., 2011). Third, this project is able to deliver validation for the effects of continuity on the outcome of hospital readmissions. The effect of continuity, at least in the sample of this project, has been quantified and found to be correlated with a reduced odds of hospital readmission. However, these results should be judiciously interpreted, and validated with new research inquiries to also correct some of the aforementioned limitations. In particular, the possibility of a false negative remains high due to the modest sample size and logistic regression assumption violation already discussed. This serves to emphasize the apparent significance of the incremental COCI measure further, however. This alludes to the fourth contribution of the project to VNA-Erie: the creation and implementation this scholarly project may serve as a blueprint for further inquiry into continuity of care in HHC in the future. Overall, the results of this project demonstrate the importance of summoning renewed efforts to improve continuity in HHC, and patient outcomes by extension.
References


https://doi.org/10.1016/j.jgo.2015.04.003

https://doi.org/10.1016/j.jhealeco.2018.03.003

doi:10.1001/jama.2016.18533

https://doi.org/10.1177/0733464812454007


https://doi.org/10.1016/j.healthpol.2018.05.013

doi: 10.1007/s11606-013-2754-0

Table 1

*High-Risk Sample Demographic Data (N = 62)*

<table>
<thead>
<tr>
<th>Case Characteristics</th>
<th>Number</th>
<th>Percent</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23</td>
<td>37.1</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>39</td>
<td>62.9</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td>68.7</td>
<td></td>
</tr>
<tr>
<td>25-34</td>
<td>2</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>35-44</td>
<td>2</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>45-54</td>
<td>5</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>55-64</td>
<td>15</td>
<td>24.2</td>
<td></td>
</tr>
<tr>
<td>&gt;65</td>
<td>38</td>
<td>61.3</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>28</td>
<td>45.2</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>25</td>
<td>40.3</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>3</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>3</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>59</td>
<td>95.2</td>
<td></td>
</tr>
<tr>
<td><strong>Diagnoses</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>6</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>6</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>Pulmonary Disease</td>
<td>6</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>Renal Disease</td>
<td>8</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>11</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>Skin Breakdown</td>
<td>11</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>14</td>
<td>22.6</td>
<td></td>
</tr>
<tr>
<td><strong>Payer Source</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicare/Traditional</td>
<td>22</td>
<td>35.5</td>
<td></td>
</tr>
<tr>
<td>Managed Medicare</td>
<td>29</td>
<td>46.8</td>
<td></td>
</tr>
<tr>
<td>Managed Medicaid</td>
<td>11</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td><strong>Living Arrangement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lives Alone</td>
<td>16</td>
<td>25.8</td>
<td></td>
</tr>
<tr>
<td>Lives with Others</td>
<td>44</td>
<td>71.0</td>
<td></td>
</tr>
<tr>
<td>Congregate Living</td>
<td>2</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td><strong>Number of Nursing Visits</strong></td>
<td></td>
<td></td>
<td>33.1</td>
</tr>
<tr>
<td>3-44</td>
<td>50</td>
<td>80.6</td>
<td></td>
</tr>
<tr>
<td>45-84</td>
<td>7</td>
<td>11.3</td>
<td></td>
</tr>
<tr>
<td>&gt;85</td>
<td>5</td>
<td>8.1</td>
<td></td>
</tr>
</tbody>
</table>
Appendix A

PRISMA Diagram

Database Records Identified
(n = 50)
CINAHL: 17
PubMed: 17
EMBASE: 10
CENTRAL via Ovid: 6

Additional records identified through other sources
(n = 26)
Reference sources: 1
Individual Journals: 12
Descendancy/Ancestry search: 13
Grey literature: 0

Records after duplicates removed
(n = 69)

Records screened
(n = 69)

Records excluded
(n = 48)

Full-text articles appraised for eligibility
(n = 21)

Full-text articles excluded
(n = 14)
Alternative Intervention: 2
Alternative Outcomes: 4
Alternative Population: 4
Lacks methodological rigor: 4

Studies included in literature review synthesis
(n = 7)

*Limiters: English, 5 years, adult patients, clinical trials/RCTs/cohort studies/observational studies/case control trials/quasi-experimental studies
Appendix B

OASIS Item M1033 – Risk for Hospitalization

(M1033) Risk for Hospitalization: Which of the following signs or symptoms characterize this patient as at risk for hospitalization? (Mark all that apply.)

- 1 - History of falls (2 or more falls – or any fall with an injury – in the past 12 months)
- 2 - Unintentional weight loss of a total of 10 pounds or more in the past 12 months
- 3 - Multiple hospitalizations (2 or more) in the past 6 months
- 4 - Multiple emergency department visits (2 or more) in the past 6 months
- 5 - Decline in mental, emotional, or behavioral status in the past 3 months
- 6 - Reported or observed history of difficulty complying with any medical instructions (for example, medications, diet, exercise) in the past 3 months
- 7 - Currently taking 5 or more medications
- 8 - Currently reports exhaustion
- 9 - Other risk(s) not listed in 1 - 8
- 10 - None of the above
Appendix C

Continuity of Care Index (COCI) Formula

\[ COCI = \frac{\sum_{j=1}^{s} n_j^2 - n}{n(n-1)} \]

Where: “n” signifies the total number of visits, “j” is each nurse, “n_j” is visits performed by nurse j, and “s” is the total number of nurses.
Appendix D

Histogram Distribution of Continuity of Care Index Scores

Distribution of Continuity of Care Index Scores

Mean = 17
Std. Dev = 146
N = 52
Appendix E

Capstone Project Gantt Chart

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder Engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature Review</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Proposal and IRB Approval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Collection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Analysis, Results, and Conclusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manuscript Editing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Submission and Capstone Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix F

IRB Approval Confirmation

May 30, 2019

Dear TYLER COLBERT,

On 5/30/2019, the University at Buffalo IRB reviewed the following submission:

<table>
<thead>
<tr>
<th>Type of Review:</th>
<th>Initial Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title of Study:</td>
<td>Continuity of Nursing Care in Home Health and its effect on Hospital Readmissions: A Retrospective Analysis</td>
</tr>
<tr>
<td>Investigator:</td>
<td>TYLER COLBERT</td>
</tr>
<tr>
<td>IRB ID:</td>
<td>STUDY00003414</td>
</tr>
<tr>
<td>Funding:</td>
<td>None</td>
</tr>
<tr>
<td>Grant ID:</td>
<td>None</td>
</tr>
<tr>
<td>IND, IDE, or HDE:</td>
<td>None</td>
</tr>
</tbody>
</table>
| Documents Reviewed: | • HRP-612 - HIPAA Waiver, Category: Other;  
|                   | • Colbert - Data Extraction Codebook, Category: Other;  
|                   | • Colbert - DNP Capstone Research Protocol - Continuity of Care, Category: IRB Protocol; |

The study materials for the project referenced above were reviewed and approved by the SUNY University at Buffalo IRB (UBIRB) by Non-Committee Review. The UBIRB has determined on 5/30/2019 that the research is Exempt according to 45 CFR Part 46.104. There is no expiration date.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the Click system.

This UBIRB determination is given with the understanding that the proposed study design will be followed. If modifications are needed that significantly alter the purpose, design, or data collected, then those changes should be submitted to the IRB to determine if the modifications alter the research such that the criteria for an exempt determination are no longer met. You can create a modification by navigating to the active study in Click IRB and selecting ‘Create Modification / CR’. Otherwise, this study no longer needs to be reviewed by the IRB.

For more information on exemption criteria and categories, see the IRB Toolkit Worksheet: Exempt Determination (HRP-312). If you have any questions about this determination, please contact the IRB.
Full HIPAA Waiver

Based on the information you have provided in the “University at Buffalo Human Research Protections Program Request for Full Waiver of Individual Authorization for Use of Individually Identifiable Health Information” form (waiver request), the UBIRB has determined a full waiver of the individual authorization required by 45 CFR §164.508 for use or disclosure of protected health information is warranted based on the following criteria as specified in 45 CFR 164.512(i) (2). Accordingly:

A) The use or disclosure of protected health information involves no more than a minimal risk to the privacy of individuals, based on, at least, the presence of the following elements:

1) An adequate plan to protect the identifiers from improper use and disclosure;

2) An adequate plan to destroy the identifiers at the earliest opportunity consistent with conduct of the research, unless there is a health or research justification for retaining the identifiers or such retention is otherwise required by law; and

3) Adequate written assurances that the protected health information will not be reused or disclosed to any other person or entity, except as required by law, for authorized oversight of the research study, or for other research for which the use or disclosure of protected health information would be permitted by this subpart;

B) The research could not practicably be conducted without the waiver or alteration; and

C) The research could not practicably be conducted without access to and use of the protected health information.

A brief description of the Protected Health Information for which this alteration or waiver has been granted is provided on the “Request for Waiver of the Authorization for Use of Individually Identifiable Health Information” or “Request for Limited Waiver of the Authorization for Use of Individually Identifiable Health Information for Study Recruitment” which is part of this approval. If HIV information is requested, this waiver is only valid for disclosures consistent with New York Code Public Health Article 27-F.

As principal investigator for this study involving human participants, you have responsibilities to the SUNY University at Buffalo IRB (UBIRB) as follows:

1. Ensuring that no subjects are enrolled prior to the IRB approval date.
2. Ensuring that the UBIRB is notified of all reportable information in accordance with the New Information SOP (HRP-024).
3. Ensuring that the protocol is followed as approved by UBIRB including minor changes which can be made if they do not impact the exempt determination.
4. Ensuring that the study is conducted in compliance with all UBIRB decisions, conditions, and requirements.
5. Bearing responsibility for all actions of the staff and sub-investigators with regard to the protocol.
6. Bearing responsibility for securing any other required approvals before research begins.
Appendix G

Capstone Project Defense Presentation

CONTINUITY OF NURSING CARE IN HOME HEALTH AND ITS EFFECT ON HOSPITAL READMISSIONS: A RETROSPECTIVE ANALYSIS

By: Tyler R. Colbert
AONP Program
Summer Semester, 2019

PROJECT QUESTION
Among high-risk adult patients who received home health care (HHC) services in the year 2018, did those with a higher level of nursing care continuity (CC) experience a reduced risk of 30-day acute hospital readmission (AHRs) compared to those with lower levels of continuity?

Home Health Continuity: Background

- Rapid expansion of Home Health Care (HHC) in recent decades
- Defined as any health service delivered in a patient’s home
- Use has increased by 40% in the last 20 years
- HHC use is expected to increase at an annual rate of 7.0% by 2024
- Compared to an annual increase of 6.2% for all health care
- HHC now cares for over 12 million patients annually
- Total national expenditure on HHC is projected to increase to nearly $150 billion by 2021
- Focus on HHC has emerged due to both narrowing health care resources and an aging population
- Due to the investment made in HHC, it is imperative that HHC officials and stakeholders continually evaluate and improve care quality

Gomez et al., 2016; Luntiah, Scheinert, Wolfers, Glassberg, & Brice, 2017; Zemans, Zemans, & Kate, 2014; Wang et al., 2014

Home Health Continuity: Significance

- Many indicators of HHC quality have emerged
  - Emergency room (ER) visits
  - Patient functional status
  - 30-day Acute Hospital Readmissions (AHRs)
- Another emerging quality measure
  - Nursing care continuity (CC)
  - A measure of the consistency of nursing personnel throughout the care episode
  - Often measured with the Continuity of Care Index (COCI) measured on a scale of 0 to 1, with higher scores indicating greater CC

Mishler et al., 2012; Groot-Brons, et al.; Leung & Pilesky, 2011; Muhlebach & Kay, 2010; Rosedale & Borrell, 2003
CONTINUITY IN HOME HEALTH CARE

Home Health Continuity: Significance

- Improvement in Continuity of Care
  - A decrease in care fragmentation will improve
    - Nurse-patient familiarity
    - Disease management
    - Ultimately patient outcomes
  - CC has examined in a plethora of different care settings
    - Specialty Care
    - Primary Care
    - Ambulatory Care
  - Evidence pertaining to CC in improving outcomes in HHC is lacking despite rapid expansion

Home Health Continuity: Project Purpose

- Purpose of the capstone project/research question:
  - To collect data relevant CC in a local HHC agency, and to determine if this data suggests any significant effects on AHRs
  - To explore the magnitude of effect that CC may have on the likelihood of patient readmission
- Topic was selected due to:
  - The increased prevalence of HHC
  - The impact CC appears to have on care quality in other settings
  - The importance of AHRs as measure of quality and cost
  - The dearth of evidence currently available in HHC
  - To provide data for HHC stakeholders to catalyze policy change and practice improvement

Home Health Continuity: Project Purpose

- Nature of the Problem
  - Patients frequently experience fragmented care
    - Derived from nurse availability, travel issues, scheduling conflicts, or patient preferences
  - Many nurses visit, with varying familiarity with a patient’s case
    - Impaired ability to recognize subtle changes in patient condition
    - Less effective communication or teaching
    - Ultimately suboptimal outcomes

- Objectives
  - Five primary study objectives
    - Collect and analyze the best available evidence
    - To demonstrate the feasibility of quantifying CC in HHC
    - To examine the association between CC and AHR
    - To present the results and implications in an accessible form
    - To disseminate project findings as an executive summary to the project site
CONTINUITY IN HOME HEALTH CARE

• King’s Theory of Goal Attainment
  - Describes transactions relevant to patient health at three systems levels
    - Individual/Personal
    - Group/Interpersonal
    - Society/Social

• King’s Theory of Goal Attainment - Assumptions
  - Humans are goal-oriented
  - Have continuous interactions with their environment
  - Primary motivation of humans is goal attainment through these interactions

• Fundamental Theory Concepts
  - Personal level: perception, self, growth, body image, space, time
  - Interpersonal level: interaction, communication, transaction, role, stress
  - Social level: organizations, power, authority, status, and decision-making

• King’s Theory was chosen for three main reasons:
  - 1. Ability to guide quality improvement initiatives
  - 2. Focus on concepts relevant to CC in HHC
    - E.g. Perception, interaction, communication, transaction, organization, decision-making
  - 3. Capacity for analyzing interacting factors within and across different levels from systems perspective

• King’s Theory and the Project Question
  - Theory emphasizes communication and transaction at the interpersonal level between nurses and clients
  - The integrity of these facets of quality care would be enhanced when care provision is more streamlined and consistent
  - Preserving these contributors to quality care could then bolster outcomes such as AHRs
CONTINUITY IN HOME HEALTH CARE

**Home Health Continuity: Literature Review**

- **Continuity in Primary/Specialty Care**
  - Studies by Bayliss et al. (2015) and Swanson, Vogt, Sundmacher, Hagen, Moger (2018)
  - Both large retrospective analyses, combined sample size of 32,100 patients from Europe and the United States
  - Bayliss et al. (2015) reported that for a 0.1 increase in COCI for primary/specialty clinic patients, a risk reduction for hospital admission of 2.5% was observed (p<.05)
  - Swanson et al. (2018) found that for every 0.1 increase in COCI, the risk of readmission was reduced by 14.5% (p<.001)

- **Continuity in Ambulatory Care**
  - Studies by Kao, Tseng, Ng, and Wu (2019) and Mondor et al. (2017)
  - Kao et al. (2019) found that patients with low or moderate COCI levels were found to have elevated risks of hospital admission for disease exacerbation over high COCI patients
  - Hazard ratios of 2.80 and 2.69 compared to high-COCI counterparts (p<.01) (Kao et al., 2019)
  - Mondor et al. (2017) discovered that low COCI was associated with an 11% increase in the risk of hospital admission
  - Effect did not persist significantly after statistical adjustment
**Continuity in Home Health Care**
- Popejoy et al. (2015) implemented an enhanced care coordination program
  - Observed a reduction in readmissions by 0.5 events per year in intervention patients over controls
- David and Kim (2018) examined the effect of HHC “handoffs”
  - Found that a single nursing handoff increased the risk of readmissions by 24% (p<.01)
- Results from Russell et al. (2011) include the finding that low and moderate COCI groups were 43% and 13% more likely to be hospitalized than high COCI patients (p<.001)

**Literature Review Conclusions**
- Continuity appears to exert protective and beneficial effects on patient outcomes, including readmissions
- Effect is observed in a variety of care settings
- Care continuity should be recognized as major indicator of care quality
- A substantial literature gap exists on CC in HHC

**Ethical Considerations**
- Ethical considerations, such as vulnerable populations, privacy, and informed consent
- Privacy and confidentiality for all patients were maintained by de-identification of patient data prior to data extraction and secure data storage
- Data was stored in a locked room on a password protected computer
- Two vulnerable patient populations were included in the sampling frame: pregnant women and cognitively-impaired results
  - There were no foreseeable risks to vulnerable populations from this study
- IRB Approval was obtained in June of 2019

**Study Methods and Design**
- Population
  - Adult high-risk HHC patients
  - Admitted to VNA-Erie medical-surgical teams 1, 2, 4, & 5
  - Admitted at any point during 2018 calendar year
  - Three or more nursing visits
    - Calculating a stable COCI requires 3+ visits
- Setting
  - Visiting Nursing Association of Western New York, Erie County (VNA-Erie)
- Stakeholder Engagement
  - Regular correspondence established with VNA-Erie executives to gauge interest and priorities
Study Methods and Design

- **Project Design**
  - Retrospective case-control study

- **Sample Size**
  - Power analysis indicated sample size of 380+
  - Estimating a modest effect size ($R^2 = .04$) with nine predictor variables, to achieve a power of 0.80 and have $\alpha = 0.05$ the necessary sample size is 380

- **Simple Random Sampling**

- **Sample Inclusion Criteria**
  - Adult patients, 3+ nursing visits, High-Risk, admitted in 2018
  - During data collection it became clear that a more modest sample would be obtained for this project however (N=62)

- **Data Collection Plan**
  - **Demographic Data**
    - Age, gender, race/ethnicity, primary diagnosis, payer source, living arrangement, number of visits/LOS
  - **Continuity Data**
    - Total number of nursing visits
    - Total number of nurses that have seen a patient
    - Number of visits performed by each nurse
    - COCIS Score from 0 to 1, higher scores indicate higher CC
  - **Readmissions Data**
    - Dichotomous coding of AHRs
    - 1=noAHR, 1=yes AHR

Data Collection – Sample Finalization

- Initial patient sample comprised 105 high-risk patients
  - 73 patients after duplicates were removed
  - The EHR was then reviewed to extract demographic and continuity data
    - As well as to ensure that patients who did not meet criteria were screened out
  - Listwise deletion was used to remove nine patients due to missing readmissions data
  - Two more patients were excluded due to an insufficient number of visits (less than three)
  - Bringing the final sample to 62 high-risk adult patients from VNA-Erie in 2018
Study Analysis and Results

**Data Analysis Plan**
- Quantification of demographic data using descriptive statistical tools
- COCI scores were calculated for each patient as well
  - Assigned to Low Continuity (LC) or Moderate-High Continuity (MHC) group
    - Low 0.00-0.29
    - Moderate-High 0.30-1.00
  - AHR occurrence were determined for each patient
- Binary logistic regression (LR) and adjusted odds ratios (aOR) to determine comparative levels of risk of AHRs among the COCI groups

Study Analysis and Results

**Data Analysis Plan – COCI Examples**
- Example: Patients A & B
  - Patient A
    - 10 visits
    - Seen by nurses X, Y, and Z
    - Visit History: YYYYYYYYZ
    - COCI Equation: \(\frac{4(5^2 + 3^2 + 2^2)}{10(10-1)} = 0.31\)
  - Patient B
    - 10 visits, nurses V, W, X, Y, Z
    - Visit History: VXZZVVVVZ
    - COCI Equation: \(\frac{4(2^2 + 2^2 + 3^2 + 1^2 + 2^2)}{10(10-1)} = 0.13\)

Study Analysis and Results

**Data Analysis Modifications – Continuity Groups**
- Low Continuity (LC) and Moderate-High Continuity (MHC) groups
  - Moderate and High continuity patients had previously been separate
  - During analysis it became apparent that merging the two groups was more feasible
    - For the moderate and high continuity levels, there were only six and one sample patients, respectively
    - Equates to approximately 9.7% and 1.6% of the sample for each group
    - Not suitable for the calculation of odds ratios

Study Analysis and Results

**Data Analysis Modifications – Incremental COCI**
- In order to test one of the assumptions of logistic regression, a new continuity variable was created
  - Incremental COCI, which split patients into ten continuity groups
  - Groups each spanned an equal range across the COCI scale
  - Increments of 10
  - Variable initially entered into the dataset for a logit step test, which will be described below
Study Analysis and Results

Data Analysis Modifications – LR Predictors

- By convention, it is recommended to have 10-20 cases per covariate in the logistic regression model (Politi, 2010)
- Preserves parameter estimate stability
- Thus only six sample variables were included in the initial simultaneous regression analysis
  - Age, gender, race, diagnosis, number of visits (NOV), and continuity group (LC and MHC)
  - A seventh variable (the incremental COCI) was entered in the final block of a sequential LR model

Data Analysis – Cleaning the Data

- Various methods of data cleaning were used
  - Missing values were handled using listwise deletion in the case of readmissions data
  - Could not use imputation or variable deletion
  - Assessment of outliers among the variables
  - One sample patient with a COCI value of 1.00
  - Screening the dataset for wild codes

Data Analysis – Testing Binary LR Assumptions

- Review of the assumptions for logistic regression
  - Independent sampling procedures
  - Multicollinearity among the scale variables
  - Outliers in the dataset
  - Linearity between continuous variables and log odds of the dependent variable
    - Logit step test was performed
    - Variables were converted into categorical to determine if regression coefficients increased in linear manner

Data Analysis – Sample Characteristics

- Descriptive statistics were then reviewed for each data category
  - Measures of skewness, kurtosis, and normality
    - Age was the only normally distributed scale variable based on the Kolmogorov-Smirnov test (p > 0.05)
  - Frequency distributions and measures of central tendency and variability were generated for categorical demographic variables
Data Analysis – Main Analysis
- Standard odds ratios for the dependent variable of AHRS were calculated for the LC and MHC groups
- 95% CIs calculated
- Then aDRs were calculated from the LR model to assess the effect of continuity group membership
- Both simultaneous and sequential binary LR models were used to assess the overall model and the effect each variable had when entered separately

Data Results – Overview of Demographic Data
- Age
  - Only normally distributed variable
  - Mean ages were 67.8 and 75.7 in the LC and MHC groups respectively, and 66.7 in the general sample
- Gender
  - 62.9% of the sample was female
  - Majority of both groups were in LC group
- Race
  - White patients comprised 45.2% of the sample, while black patients accounted for 40.3%, Latinos added 4.8%, and 9.8% were categorized as other

Data Results – Review of Demographic Data
- Payer source
  - 46.8% received benefits through managed Medicare
  - 17.7% through managed Medicaid
  - 35.5% through traditional fee-for-service Medicare
- Primary Diagnosis
  - Cardiac disease, pulmonary disease, and diabetes
  - 9.7% each
  - Cancer and skin breakdown
  - 17.7% each
  - Renal disease accounted for 12.9%
  - Remaining 22.6% of patients had unspecified diagnoses

Data Results – Number of Visits (NOV) and COCI
- NOV
  - Mean NOV for LC and MHC groups were 52.9 and 30.6
  - Difference not found to be statistically significant according to Mann-Whitney U test (p=1.00)
- COCI
  - Mean COCI score for all sample patients was 0.17
  - Percent below 0.30 (i.e. LC patients): 98.7%
  - Positively skewed and leptokurtic distribution
CONTINUITY IN HOME HEALTH CARE

Study Analysis and Results

Data Results – COCI Distribution

- Distribution of Continuity of Care Index

Study Analysis and Results

Data Results – Readmissions between LC and MHC

- Of all sample patients, 20 (22.3%) experienced an AHR
  - Remaining 42 (67.7%) did not
- Readmissions not evenly distributed among LC and MHC groups
  - Of those readmitted, only 5% (one patient) was an MHC patient
  - Remaining 95% (34.5% of that patient group) were from LC
- Majority (85.7%) of MHC patients were not readmitted

Study Analysis and Results

Data Results – Odds Ratios and COCI means

- Based on the data for each group, standard ORs for 30-day AHRs:
  - OR=3.17 (95% CI = 0.36-28.26)
  - However this initial risk index did not reach statistical significance (p=.30)
- Mean COCI score for the readmitted and non-readmitted groups
  - Readmitted: 137
  - Non-readmitted: 193
  - This result was not deemed statistically significant (p=14)
- Thus a binary LR model was created to more precisely analyze the impact of CO on AHR risk

Study Analysis and Results

Data Results – Simultaneous Binary LR

- Performed to control the influence of confounding variables, and identify whether and to what degree continuity may have exerted an independent effect
- Result of the simultaneous model
  - aOR of 30-day AHRs for LC compared to MHC patients was 2.45 (95% CI=0.17-34.48) with a Wald statistic (measure of significance in LR) of 0.44
  - However, not statistically significant (p=.51)
- The simultaneous LR model failed to reject the null hypothesis of continuity’s impact on AHR risk
CONTINUITY IN HOME HEALTH CARE

**Study Analysis and Results**

**Data Results – Sequential Binary LR**
- A different result was noted when a sequential regression model was used.
- Data was entered in three successive blocks to establish statistical control and build the model.
- Demographic variables (age, gender, race, diagnosis, etc.) entered in block one.
- Continuity group status (LC and MHC) entered in block two.
- In the third block, incremental COC1 was entered.
  - For this variable, the aOR=3.02 (95% CI=1.016-8.97) and a Wald statistic of 3.95 (p=.047).

**Study Discussion and Conclusion**

**Discussion – Resemblance to other studies**
- Sample in this project exhibited similarities to other HHC patient samples in larger studies from the literature.
- Similar sample patient profiles with respect to demographics such as mean age, most prevalent diagnoses, gender and race.
- Exhibited mean COC1 generally below means of other studies in the literature.
  - Means in studies by Kao et al. (2019) and Russell et al. (2011) were 0.55 and 0.54, respectively.
  - Compared to 0.17 in this study.

**Study Discussion and Conclusion**

**Discussion – Binary LR Models and Nagelkerke’s R²**
- Nagelkerke’s R² (33) indicated roughly 33% of the variance in the distribution of the outcome variable was captured by the model.
- Another interesting result from the sequential model was informative changes that occurred in block to block with respect to R² measure.
  - Very little change (less than 1%) between blocks one and two as LC and MHC groups were added to demographics (x²=0).
  - When the incremental COC1 measure was added to the model however, R² rose by 8% to .33.
  - This indicates that a modest but substantial portion of the variance (roughly 8%) is accounted for by this variable alone.

**Study Discussion and Conclusion**

**Discussion – Overall LR Model Effects**
- The difference between the -2 log of the likelihoods (-2LL) between the null and full regression models did not achieve statistical significance, however.
  - The full sequential model chi-square=16.68 (p=.27).
  - This represents the difference in the -2LL of the full and full models.
  - Commonly referred to as the likelihood ratio test.
  - Ratio between the likelihood indexes of the null and full models.
Discussion – Individual Effects in the LR Models

- The demographic covariates of age, gender, and race appeared to have no discernible effect on the outcome, nor did any of these approach statistical significance (p<.05 for all three).
- These results are similar for the patients’ primary diagnosis, NOV, and surprisingly for the LC and MHC groups.

Discussion – Project Strengths and Limitations

- Limitations
  - Modest sample size (N=62)
  - Post hoc power analysis
  - Based on observed effect size (Cramer’s V=0.14 in this project) the sample size (N=62), and desired a level, the power behind the analysis appeared to be less than 85%
  - Leaves the project results vulnerable to Type II error
  - Use of exclusively retrospective methods introduces possibility of bias
  - Disparity in the group sizes between LC and MHC patients

Discussion – Individual Effects in the LR Models

- The incremental COCI variable returned a different result
  - For this variable the aOR=3.02 (95% CI=1.02-8.97, p=.047)
  - For each unit increase in COCI (by increments of .10) there is a threefold decrease in the odds of a 30-day AHR
  - Continuity therefore appears to exert a measurable effect
  - Role of continuity should be further explored to ensure HHC patients are provided optimal care to improve outcomes
Study Discussion and Conclusion

Discussion – Project Strengths and Limitations

- Strengths
  - Most LR assumptions were not violated
  - Multicollinearity – no significant correlations among scale measures
  - Outliers – did not affect the sequential regression model
    significance and was 2.24 SDs above the mean, cutoff of 2.58
    standardized units is often advocated
  - Independent sampling – used in this study
  - Random sampling procedures
  - Strict adherence to eligibility criteria
  - Adaptation to modest sample size through covariate selection and merger of
    LC and MHC groups

- Limitations
  - Limited sample size

Additional Strengths

- Statistical significance of incremental COC measure
- Confounding influences controlled through the original LR model
- Through order of covariate entry into the model
- I.e., alternative sequential LR equations
- Inclusion of incremental COC in simultaneous model
- Sequential model which excluded outliers
- All returned similar, statistically robust results
- Patient sample exclusively examined patients who were deemed at the highest risk of an AHR

Directions for Future Research

- Alternative outcomes measures
- Effect of continuity on days to readmission in HHC
- ED visitation
- Functional abilities measurement
- Patient satisfaction
- Cost-Effectiveness Analysis
- Alternative methods for cultivating continuity
  - E.g., telehealth
- Quota sampling
  - Ensure approximate equivalence between groups and adequate sample size
  - Allow of for inclusion of more predictors, fulfer model

Contributions to Advanced Nursing Practice

- DNP Essential V: Health Care Policy for Advocacy in Health Care
  - Ensuring HHC agency policy is evidence-based and patient-centered
- DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking
  - Integration of multiple system levels’ considerations
  - E.g., organizational concerns of resource allocation, scheduling
    or interpersonal factors such as patient/nurse familiarity, and personal level of patient experience and perception
- Highlights relevance of King’s Goal Attainment Theory to HHC
  and CC

(Notes, further research & future studies)
Contributions to Advanced Nursing Practice
- DNP Essential VII: Clinical Prevention and Population Health for Improving the Nation’s Health
- Emphasizes the importance of research and nursing knowledge generation to improve the health of whole patient populations
- Reinforces focus on preventing complications in individual patients often associated with hospital readmissions

References

Project Conclusion
- Main goals of this capstone project were to:
  - Collect data relevant to CC in a local HHC agency, and to determine if this data suggests any significant effects on AHRRs.
  - To explore the magnitude of effect that CC may have on the likelihood of patient readmission
  - This measure appears to exert an significant effect based on the evidence this project managed to assemble

Contributions to Capstone Clinical Site
- Introduction of COCl as a new metric of continuity
- Identification of relatively high levels of dispersion (i.e., low continuity) among this patient sample
- Validation of the effects of continuity on a major HHC outcomes measure
- In this project, progressively higher levels of continuity among these patients was associated with a commensurately reduced odds of an AHRR
- Foundation for future research into role of continuity
- An executive summary will be submitted to the VNA upon capstone completion
References


https://doi.org/10.1097/JCN.0000000000000018

https://doi.org/10.1097/JCN.0000000000000018
Appendix H
Capstone Clinical Site Executive Summary

Clinical Problem: Patients frequently experience fragmented care, and this discontinuity is contributes to suboptimal outcomes. Continuity is of special importance to home health care, where nurses are ideally placed to establish familiarity with patients, deliver relevant teaching, and detect early clinical changes.

Project Purpose: The purpose of this DNP Capstone project was to collect and analyze data to determine the effect of nursing care continuity on 30-day hospital readmissions in a high-risk sample of patients.

Project Question: Among high-risk adult patients who received home health care (HHC) services in the year 2018, did those with a higher level of nursing care continuity (CC) experience a reduced risk of 30-day acute hospital readmission (AHRs) compared to those with lower levels of continuity?

Project Aims and Objectives: This project had five main objectives. First, to collect and analyze the best available evidence in the nursing and health care literature on the topic of patient continuity and hospital readmissions. Second, to demonstrate and apply an evidence-based method for quantifying care continuity. Third, to examine the relationship between nursing continuity and readmissions. Fourth, to present the results and practice implications to stakeholders and other interested parties. Fifth and finally, to disseminate the major findings of the project to the project site: the VNA of Erie county.

Methods: This project identified 62 high-risk adult patients who received care from VNA-Erie in 2018. Demographic data was collected on these patients, as well as continuity measurements using the Continuity of Care Index that is used frequently in similar studies. Readmissions data was then reviewed for each patient, and all data was coded appropriately and analyzed using statistical software. Logistic regression was used as the main analysis to determine comparative levels of risk between patients with lower or higher levels of care continuity.

Results: The sample from this project resembled samples from larger studies in many ways, such as representation of race, gender, and diagnoses. Neither demographic variables nor number of visits appeared to exert an effect on odds of readmission. However, a significant result was observed with respect to continuity. An increase in the COCI scores of 10% was associated with a threefold decrease in the odds of a 30-day hospital readmission (aOR=3.02 (95% CI=1.016-8.97, p=.047).

Conclusions: Based on the initial data generated by this research, continuity does indeed appear to have a substantial, protective effect on one of the most clinically relevant patient outcomes. Further inquiry to more fully illuminate the role of continuity in the contexts of other outcomes, patient populations, clinical disciplines, and methods of preserving care continuity should be pursued.