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Nurse Practitioners Use of Clinical Decision Support Tools in Heart Failure

Rosemary Thomas-Cloud
Georgia State University

Kimberly Hires
Georgia State University

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Abstract

Background: Heart failure (HF) is a progressive disorder which results in poor patient outcomes for those affected. Although there are evidence-based medications to alter the progression and improve outcomes, provider adherence to these medications has been suboptimal. Clinical decision support tools (CDS) within the electronic medical record are effective tools in medical management.

Objective: The primary objective was to evaluate the use of CDS to nurse practitioners (NPs) adherence of guideline-directed medical therapy in HF patients in the outpatient setting. The secondary objective was to assess the NPs perception of facilitators and barriers that may affect the use of CDS.

Methods: A retrospective chart review was performed to extract HF measures and preventative care processes documented during an 18-month period by two NPs at two local primary care clinics in Southeast U.S. Descriptive analysis of the chart data was performed to compare the results of the Centers for Medicare and Medicaid (CMS) National performance quality indicators. Additional data was obtained from questionnaires that assess NPs perceptions and factors that affect the use of CDS.

Results: Collectively, the NPs performance fell below CMS results. However, one NP exceeded CMS indicators in all areas except blood pressure control. Although the NPs had some knowledge of CDS, CDS was not used with each patient contact. The satisfaction of CDS among the NPs was mixed.

Conclusion: CDS use was not verified as a driving factor to the low-performance results as the use of CDS among the NPs was low. Initiation or adjustment of HF therapy by the NPs could not be verified within this QIP. Provider education of GDMT and CDS is key to

improving HF outcomes. Further research using pre- and post-intervention analysis is warranted.

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Nurse Practitioners Use of Clinical Decision Support Tools in Heart Failure Management

In March 2010, the Affordable Care Act (ACA) mandated that healthcare organizations replace paper-based records with electronic medical records (EMRs). The ACA provides incentives to providers who adopt electronic medical records (Kocher, Emanuel, and DeParle 2010). EMRs deliver many benefits to providers including access to patients' medical history, current medical treatments, and clinical decision support tools (CDS). CDS are evidence-based decision aids embedded within the EMR that provide guideline-directed reminders at the point of contact for timely clinical management of the patient (Vetter et al., 2015). These tools can support and influence providers in the outpatient setting when providing care to patients with heart failure (HF) (Gold & McLaughlin, 2016). Due to the chronicity of HF, nurse practitioners (NPs) are often charged with managing the care of this patient population in outpatient settings. Although practices for improvement are evolving, NPs are not using these aids to improve decision making in the management of patients with heart failure (Mitchell, Revere, & Ayadi, 2014; Walsh et al., 2010).

In this quality improvement project (QIP), the student investigator (SI) examines the background and significance of adequate HF management among NPs in the outpatient setting. A review of the literature is performed to assess CDS influence on NPs decisions when managing heart failure patients. Finally, data from two NP-led primary care practices are analyzed using Donabedian's Conceptual Framework to evaluate CDS use and the delivery of guideline-directed medical therapy (GDMT) in heart failure patients.

Background and Significance

Heart failure is a progressive multifactorial disorder that affects over 6 million adults. The incidence of HF doubles in men and triples in females across a ten-year span. Individuals

over the age of 65 years of age have the greatest risk of developing HF. African Americans have a greater incidence of HF than any other nationality (Benjamin et al., 2018; Yancy et al., 2017). Fifty percent of HF patients will die within five years of diagnosis (Benjamin et al., 2018). Current research trends show a declining incidence of HF but a rising prevalence of HF (Komanduri et al., 2017). These changes may be due to an increase of awareness of HF signs and symptoms and improved diagnostic and treatment (Komanduri et al., 2017). National hospital admission rates have doubled, and costs of care are expected to rise from $30 billion to $69 billion by the year 2030 (CDC, 2016; Komanduri et al., 2017). In the state of Georgia, mortality rates are 5% greater than the national rates. (Georgia Department of Public Health, 2015).

The American College of Cardiology (ACC), the American Heart Association (AHA) Task Force on Clinical Practice Guidelines and the Heart Failure Society of America (HFSA) have developed clear guidelines for the care of patients with HF (Yancy et al., 2017). The guidelines include medications such as angiotensin-converting enzyme inhibitor (ACEi), angiotensin receptor blocker (ARB), an angiotensin receptor–neprilysin inhibitor (ARNI), and beta blockers (BB). These medications have all proven to improve symptoms and extend life (Yancy et al., 2017).

ACEI and ARBS are drugs that affect the renin-angiotensin-aldosterone system (RAAS) at different pathways within the system. ACEi inhibits kininase and increase levels of bradykinin and is recommended for mild, moderate, or severe symptoms of HF. A major side effect of ACEi is angioedema and a cough. ARBs do not inhibit kininase and are less associated with angioedema and cough (Yancy et al., 2017). ACEi and ARBS have a 17% relative reduction rate of mortality and a 31% relative reduction rate hospitalization. ARNI is combined

with an ARB and a neprilysin inhibitor. Neprilysin breaks down natriuretic peptides, bradykinin, adrenomedullin, and other vasoactive peptides. ARNI has shown to reduce mortality and hospitalization by 20% for those with symptomatic HF who are naïve or previously tolerated an adequate dose of ACEi or ARB. ACEi, ARBs, and ARNI should be used with caution in patients with low systemic blood pressures, renal insufficiency, or elevated serum potassium (Yancy et al., 2017). BBs reduce the mortality rate by 35%. BBs are better on improving ejection fraction, reducing ischemia, and the risk of sudden death. BBs are recommended in all patients with mild to moderate heart failure. A combination of a BB and ACEi, ARB, or ARNI is recommended particularly in those with HF with a reduced left ventricular ejection fraction. Recommendations for these GDMT are to start low and titrate to maximum effect (Yancy et al., 2017). Although these medications modify the progression and improve the quality of life for an individual with heart failure, clinicians do not utilize these therapies as recommended (Walsh et al., 2010).

To improve the delivery of guideline-directed medical therapy (GDMT) and healthcare outcomes, the EMR may be beneficial (Gold & McLaughlin, 2016). The ACA provided financial incentives to providers who adopt and implement an EMR within their practice (Kocher et al., 2010). The goal was to increase access to healthcare information and improve healthcare outcomes (Kocher et al., 2010). Additional monetary incentives linked to health outcomes are provided by the Centers for Medicare and Medicaid (CMS) (Bardach et al., 2013). EMRs are embedded with clinical decision support (CDS) tools that provide clinicians with specific evidence-based options to assist with the medical management of patients (Mitchell et al., 2014). CDS adherence improves outcomes (Mitchell et al., 2014; Niemi, Geary, Quinn, Larrabee, & Brown, 2009). Also, providers can readily address CMS outcome measures with CDS. The

Community Preventative Services Task Force (2013) recommend the use of CDS embedded with the EMR for the prevention of cardiovascular disease in the outpatient setting. These recommendations were based on modest improvements in quality of care outcomes such as blood pressure control and smoking cessation. As technology advances, CDS use has the potential for greater improvements in HF patients. Without a deliberate effort to use this technology, the burden of heart failure will remain unchanged (Hopkins, 2015; Njie et al., 2015).

Problem Statement

NPs provide direct health care services to populations across the lifespan in various healthcare settings. In the primary care setting, NPs are providing 90% of the services at a reduced cost and with the same liability costs as a primary care physician (Kraus & DuBois, 2016). The focus of the NP in this setting is the management and coordination of patients' preventative and chronic health needs (Scordo et al., 2016). Management of HF patients requires incorporating and integrating care among many providers (Kuo et al., 2018). With adequate HF management, patients have decreased exacerbations, hospitalizations, and mortality rate (Mitchell et al., 2014; Connelly et al., 2012). Also, the evidence shows CDS improves preventative care processes in cardiovascular patients (Hopkins, 2015). Despite the evidence, management of HF patients with GDMT is suboptimal (Walsh et al., 2010). As an NP who uses clinical decision support tools for ordering, prescribing and educating patients in the inpatient cardiology setting, this QIP will examine the impact of CDS tools in improving the medical management in HF patients treated in the outpatient setting.

Clinical Question

Does the use of CDS tools impact a nurse practitioner's adherence to guideline-directed medical therapy in adult patients with heart failure in the outpatient setting?

Review and Synthesis of the Literature

Search Strategy

A literature review was performed using the following electronic databases: Cochrane Library, CINAHL, and PubMed Clinical Queries. Several MeSH terms were used such as computerized decision support tools, clinical decision-making tools, electronic medical record, electronic health record, heart failure, adults, heart disease, guideline-directed therapy, provider adherence, acute heart failure, chronic heart failure, systolic heart failure, and diastolic heart failure. These MeSH terms were used individually or in combination to find a variety of published evidence. A total of 38 articles were found related to the use of CDS in various populations (i.e., diabetes, atrial fibrillation, and hypertension) within the outpatient and inpatient settings. Articles were selected for review if they met the following inclusion criteria: CDS tools, adults only, range between 2008 and 2018, published in English, HF, and chronic disease processes.

Search Results

After careful review, a total of 11 articles were selected: three systematic reviews, three randomized controlled trials, and five observational studies. In this review, three of the five studies published in the United States are observational. Outcome targets in nine of eleven of the studies are related to providers, patients or both and health outcomes in two studies. Health populations include heart failure and some form of cardiovascular disease (CVD). CDS is evaluated in nine out of ten the studies reviewed.

Evidence Level and Quality

The quality of the articles was evaluated using the Johns Hopkins Nursing Evidence-based Practice Model (JHNEP). The model has three (I, II, II) levels for research evidence and

two (IV, V) levels for non-research evidence. The levels of research and type of trials are listed as follows:

Level I: Random controlled trials (RCT) and systematic reviews (SR) of RCT

Level II: Quasi-experimental studies and systematic review of mixed experimental studies.

Level III: Non-experimental studies and systematic reviews of experimental and non-experimental studies (Dang & Dearholt. 2017)

Quality of evidence within this model is assessed at each level and appraised as (a) for high, (b) for good, and (c) for low based on the consistency of the results, level of control, and the strength of results and evidence (Dang & Dearholt. 2017). The appraisal for the studies in this review is three-Ia, two-IIa, one-IIb, four-IIIa, and one-IIIb (Appendix A).

Synthesis of the Evidence

CDS on Outcomes. In this QIP, the associations of CDS on provider and patient outcomes were neutral in some outcomes and modest in others (Arts, Abu-Hanna, Medlock, & van Weert, 2017; Peiris et al., 2015; Anchala et al., 2012; Gill et al., 2009; Pearson et al., 2009). Provider outcomes included measures such as ordering and prescribing patterns. Patient outcomes included patient lab values and processes for reducing cardiovascular disease (CVD) risk such as blood pressure control.

Valadri et al., (2017) found acceptable rates of initial doses of BB at 86.4% and low rates of ACEi/ARBs at 60.3%. The rates of optimal doses for BB and ACEi/ARBs were below acceptable rates. The researchers noted that optimizing doses for these medications were not consistently noted in the charts (Valadri et al., 2017). In another study, the use of ACEi, ARBs, and BBs was lowest among PCPs versus an HF team or a cardiologist in the outpatient setting

(Crissinger, Marchionda, & Dunlap, 2015). There were modest improvements in the rates of target doses of ACEi and ARBs with no significant improvements in optimal doses of BBs in a comparison study of EMR use to paper charting in HF quality indicators (Walsh et al., 2010). Furthermore, researchers found there were low provider performance rates in four heart failure measures with CDS implementation versus post-implementation, and rates were lowest in the southern region of the United States (Mitchell et al., 2014).

In an SR, there were insignificant improvements with preventative care related to blood pressure management in four studies with CDS use, however the one study with improvements HF measures noted improvements were at the cost of increased hospital readmissions (Anchala et al., 2012). The results of an RCT had improvements in screenings for CVD risk factors with CDS use, but low rates of evidenced-based drugs in individuals at high risk of CVD (Peiris et al., 2015). A small significant effect of CDS use was noted on quality measures for lipid testing for patients at high-risk for CVD and in lipid screening (Gill et al., 2009). Findings of increased financial savings with fewer laboratory, procedures, and prescription orders were noted when researchers evaluated the EMR effect on HF outcomes in the emergency room (Connelly et al., 2012).

Impact related to CDS. The impact of CDS on hospitalizations, 30-day readmissions and mortality were mixed. Among three studies that reported on hospitalizations and mortality, two showed a positive impact of CDS use and readmissions (Mitchell et al., 2014; Anchala et al., 2012; Connelly et al., 2012). There was one study with a positive association with CDS and a reduction of 30-day readmission (Connelly et al., 2012).

CDS Adherence Factors. In most of the studies, provider adherence to CDS and GDMT was low. The barriers related to provider adherence included lack of time, too many system

alerts, EMR limitations (Arts et al., 2017). Other barriers included provider awareness, knowledge, and experience with CDS. Valadri et al. (2017) suggest inconsistent documentation practices among primary care providers may contribute to the perception of a lack of adherence to GDMT. Facilitators to use of CDS and GDMT were educational and administrative support during the implementation of CDS but was only beneficial with provider acceptance (Pearson et al., 2009; Walsh et al., 2010). Pearson et, al (2009) examined mostly RCTs in a systematic review that showed GDMT adherence was more successful with educational support (Pearson et, al 2009). In an RCT, the researchers propose educational support for provider adherence to CDS and GDMT as post ad hoc improvements were noted in primary and secondary CVD management (Peiris et al., 2015).

Gap Analysis

Despite the claims that CDS improves healthcare outcomes, the results of the evidence are inconsistent. The impact of CDS on these outcomes was not statistically significant in most articles reviewed (Arts, et al., 2017; Bryan & Boren, 2008; Gill, 2009; Pearson et al., 2009; Peiris et al., 2015; Anchala et al., 2012; Walsh et al., 2010). Only a few studies reported on heart failure outcomes among NPs and the use of CDS. The articles related to HF (N=5) focused mostly on physicians and inpatient care and two that examined the effect of CDS. Sample bias, choice of outcome measures, and diverse EMR technology were provided as issues with designs of some studies (Arts, at al., 2017; Anchala et al., 2012; Bryan & Boren, 2008).

Project Objectives

The primary objective of this DNP project was to evaluate CDS impact on NPs adherence of GDMT in HF patients in the primary care setting. Audits of charts were completed for heart failure patients seen during 01/01/2017-06/30/2018 by evaluating the frequency GDMT and

preventative care documented within the patient's chart. The charts' data extracted were documentation of an ACEi or ARB, ARNI, BB, smoking cessation counseling, and blood pressure control. Secondary objectives were to assess the nurse practitioners perceptions of facilitators and barriers in the use of CDS. Any hospitalizations or deaths were included if documented during the study period.

Conceptual/Theoretical Framework

A conceptual framework is an atlas that shapes and supports a research question and provides clarity by integrating conceptual processes (Moran et al., 2017). Donabedian's conceptual framework is a framework for a quality healthcare inquiry (Berwick & Fox, 2016). Avedis Donabedian's framework utilizes a three-tier approach to evaluate quality in healthcare (Ribeiro-Bittencourt, Ferreira-Santana, Kassladou-Menezes, Cimador & Delvalle, 2016). The framework consists of tenets created to evaluate management specifically, structure, process, and outcome (Ribeiro-Bittencourt et al., 2016). These tenets or constructs were used to guide the DNP research question.

According to Sund, Iwarsson, and Brandt (2015), the structure within the framework includes permanent or temporary organizational constructs, which may include cost and regulatory guidelines. Process refers to the standards of care and evidence-based guidelines within healthcare practices including the ability to identify, diagnose and provide appropriate care (Ribeiro-Bittencourt et al., 2016). The outcome is the final construct and relates to the results of the research question as related to competency and clinical behavior (Ribeiro-Bittencourt et al., 2016).

The constructs within the Donabedian's framework are beneficial to the DNP project as it examines variables that affect a project's structure and outcome (Moran et al., 2017). Also, it

adds value to a project's variables by showing meaningful relationships within the constructs of the framework. McKay & Wieck (2014) eludes to the dynamic nature of the framework stating, "changes in structures and processes of care are required to optimize patient outcomes" (p. 249).

Donabedian's conceptual framework when applied to the proposed DNP project, will guide the inquiry to assess outcome quality resulting from the research question. The constructs as it relates to the project's variables are as follows:

Structure: Two primary care clinics using EMR integrated with CDS to deliver GDMT to HF patients

Process: Documentation of ACEi, ARB, ARNI, and a BB or contraindication of these medications, and documentation of blood pressure control <140/90 and smoking cessation screening and counseling

Outcome: Chart audit results of process documentation measures and comparison to CMS 2016 performance results

Donabedian's conceptual framework will provide structure, definition, and clarity to investigate, predict, and evaluate the proposed project clinical question.

Methodology

In this QIP, data from a retrospective chart review and questionnaires were evaluated using descriptive analysis. The quantitative design allowed the SI to quantify the study variables (Bonnel & Smith, 2014). Descriptive non-experimental methods were used to better understand the results of the question (Bonnel & Smith, 2014).

Data collection using chart audits offered an inexpensive opportunity to understand past data. The process was easy and less time consuming than methods in experimental design (Barick et al., 2018). The providers provided answers to the open-ended questionnaire that

asked about the nurse practitioner use and perceptions of clinical decision support tools in the outpatient setting. Follow-up face-to-face visits were performed to obtain additional comments.

Ethical considerations

Approval for the QIP was obtained from Georgia State University Institutional Review Board (IRB). Informed consent was also granted for the participating NPs. Letters of cooperation were obtained from two local primary care clinics.

Population/Sample

Sampling Method

Convenience and purposive sampling methods were used for the selection of chart reviews and primary care NPs. These non-probability sampling methods were chosen versus a probability method because the population is readily accessible, appropriate for the needs of the project, and financial costs were negligible (Jager, Putnick, & Bornstein, 2017).

Sampling Criteria

The sample size was derived from the monthly patient volume and nurse practitioner staffing of each clinic. The monthly patient load was approximately 300 in Clinic A with about 12 active heart failure patients. Clinic B patient load was approximately 400 with about 10 active heart failure patients. A sample size of 30 charts from Clinic A and 40 charts from Clinic B will be adequate for review. The sample size for the NPs answering the questionnaire was two, one from each of the participating clinics.

Participants and Inclusion/Exclusion Criteria

The inclusion criteria for chart review included adults 18 years old or greater with a diagnosis of heart failure with or without symptoms seen between 01/01/2017-06/30/2018.

Patients with known obstructive pulmonary disease or asthma were excluded as exacerbation are sometimes difficult to ascertain, and BBs are controversial in this population (Lim et al., 2017).

The inclusion criteria for NP data included board-certification as a nurse practitioner, at least three years practicing in the outpatient setting and manage heart failure patients. Of the two participating NPs, one holds a master's degree in nursing, and the other has a Doctor of Nursing Practice. Both NPs have board certifications as family practice nurse practitioners and more than three years practicing as an NP in the outpatient setting, and both NPs manage heart failure patients.

Setting

The two participating clinics are located in the south Atlanta metropolitan Counties of Henry and Clayton. According to the 2010 U.S. Census Bureau, Clayton County has a population of about 259,424 with about 58,797 over the age of 18 and Henry County has a population of 203,922 with about 59,657 over the age of 18.

Clinic A is located in Forest Park, Georgia and serves the population of Clayton County and provide care for patients age six months and greater. The clinic has five examination rooms. The nurse practitioner treats about 15 patients a day and manages patients with heart failure. Clinic B is located in McDonough, Georgia and serves the people of Henry County and provide care for patients age six months and greater. The clinic has four exam rooms. The nurse practitioner treats about 20 patients a day and manages patients with heart failure.

Both clinics have four full-time staff members: an administrator, front office receptionist, medical assistant, and a nurse practitioner. The clinics use the same cloud-based medical health records system. The system has clinical decision supports embedded to help with medical management.

Data Collection

Chart review

The student investigator (SI) extracted chart data from the electronic medical record of both clinics. The SI identified a total of 34 charts based on inclusion criteria: 11 charts from Clinic A and 23 charts from Clinic B. Two charts were randomly selected from both clinic sites to verify data initially reviewed for errors to improve reliability.

The SI transcribed chart data onto the data collection sheet. Chart data variables included demographic information: medical record number, date of birth, gender, and ethnicity. Additional healthcare data abstracted include International Classification of Diseases (ICD)10 diagnosis codes for heart failure and heart failure symptoms, the number of comorbid conditions (0-2, 3-4, ≥5), documentation of an angiotensin-converting enzyme inhibitor (ACEi), angiotensin receptor blocker (ARB), or a beta-blocker (BB), blood pressure, smoking cessation counseling, hospitalization, and death rates (Appendix B).

Questionnaire

A paper-based questionnaire was created by the student investigator to examine the nurse practitioner use and perceptions of clinical decision support tools in the outpatient setting. The questionnaire was adopted and modified using a tool from the Agency for Healthcare Research and Quality to meet the requirements of the study (2012). The questions included a checklist of structured answers. Questions 1-5 were related to the design of the EMR and CDS. Questions 6-9 examined the use and perceptions of CDS. Questions 6-8 allowed the provider to explain any answer chosen. Question 10 included six demographics questions for comparative provider analysis. Question 11 assessed the provider's perceived knowledge level of CDS. Provider data

included age, gender, ethnicity, clinical experience, knowledge, and perceptions of the use of clinical decision support tools (Appendix C).

Reliability and Validity

Reliability of the questionnaire is unknown to date. A lack of evidence about the use of the questionnaire among nurse practitioners warrants a reliability analysis in the future. The SI maintained data validity by designing the collection tools, defining the variables, and collecting the data for the retrospective chart review and the provider interview. A follow-up review of data was performed by the SI of two charts from the initial audit for transcription accuracy.

Data Evaluation

The CMS (2018) quality measures were used to compare data extracted from the chart. The CMS measures include the provision of an ACEi or ARB, BB, and risk reduction with smoking cessation counseling, and blood pressure control (<140/90).

Data Management and Analysis

An analysis was performed comparing CMS measures to the treatment and management practices of the participating nurse practitioners to identify areas for improvement. Data were analyzed using IBM's Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were used to quantify data variables (Sebastiao & St. Peter, 2018). Data analysis included frequency, means, range and standard deviation (SD) to provide clarity to the data. Means and standard deviations were used for continuous variables such as age and blood pressure and percentage for categorical variables such as gender and co-morbid conditions (0-2, 3-4, ≥5).

Results

Chart Audits

Data from 34 charts were extracted for the analysis. There were eleven charts from Clinic A and 23 from Clinic B. Of the 34 charts; there were 14 with 53 multiple encounters, seven from each clinic. There were 20 charts with a single encounter, four from clinic A and 16 from clinic B.

Of the total charts reviewed, 44.1 % male and female 55.9 % male. The age of patients ranged from 35 to 86 years with a mean age of 62.91 (13.11). Most charts reviewed belonged to patients documented as Black 82.4 % (Table 1).

Table 1

Demographic Characteristics of the Chart Sample (N=34)

Demographic		Clinic A		Clinic B		Total	
		N	%	N	%	N	%
Age (years)							
	35-44	1	9.1	1	4.3	2	5.9
	45-54	3	27.3	4	17.4	7	20.6
	55-64	5	45.5	6	26.1	11	32.4
	65-74	0	0	6	26.1	6	17.6
	75-84	2	18.2	5	21.7	7	20.6
	84-96	0	0	1	4.3	1	2.9
Gender							
	Male	7	63.6	8	34.8	15	44.1
	Female	4	36.4	15	65.2	19	55.9
Ethnicity							
	Black	11	100	17	73.9	28	82.4
	White	0	0	6	26.1	6	17.6

The clinical characteristics of the sample included heart failure ICD codes, the number of co-morbidities (0-2, 3-4, ≥5), and symptoms (dyspnea, fatigue, edema, orthopnea, pulmonary rales, JVD, and hepatomegaly). ICD 10 code I50.9 was the most frequent code documented for heart failure, unspecified 52.9% (n = 18). The code I50 was the second most code noted and is unbillable. The chart review showed patients had at least one co-morbidity, 0-2 co-morbidities (29.4%), 3-4 co-morbidities (61.8 %) and, ≥5 co-morbidities (8.8%). Those that presented with symptoms were 35.3%. (Table 2).

Table 2

Chart Sample Characteristics

Clinical Characteristic	Clinic #1		Clinic #2		Total	
	n	%	n	%	n	%
ICD 10 Code						
I50	6	54.5	0	0	6	17.6
I50.1	1	9.1	0	0	1	2.9
I50.3	4	36.4	1	4.3	5	14.7
I50.9	0	0	18	78.3	18	52.9
R06.00	0	0	3	13.0	3	8.8
R06.01	0	0	1	4.3	1	2.9
Number of Co-Morbidities						
0-2	3	27.3	7	30.4	10	29.4
3-4	7	63.6	14	60.9	21	61.8
≥5	1	9.1	2	8.7	3	8.8
Symptoms						
Yes	2	18.2	10	43.5	12	35.5
No	9	81.8	13	56.5	22	64.7

Charts documented as smokers with smoking cessation counseling was 47.1%, 32.4% were non-smokers, and 20.6% did have documented evidence. BP control was 41.2% for <140/90 and 58.8% for >140/90. The mean systolic blood pressure was 149.32 (range 97-230, SD=29.238) and the mean diastolic blood pressure was 79.85 (range 55-116, SD = 13.87) (Table 14). The results for GDMT was 55.9% (ACEI 32.4%, ARB 17.6%, ARNI 5.9% contraindications (CIs) 17.6%). Documentation was missing for 26.5% of the charts. There were 79.4% charts with a documented BB, 17.6 % with CI to therapy and 2.9 % without documented therapy within the chart (See Table 3).

Table 3

Process Outcomes (N=34)

Process	Clinic #1		Clinic #2		Total	
	n	%	n	%	n	%
Smoking Cessation Counseling						
Smokers	-	-	16	69.6	16	47.1
Non-smokers	4	36.4	7	30.4	11	32.4
Not documented	7	63.6	-	-	7	20.6
Blood Pressure ≤140/90						
Yes	4	36.4	10	43.5	14	41.2
No	7	63.6	13	56.5	20	58.8
RAAS Therapy						
ACEI	3	27.3	8	34.8	11	32.4
ARB	2	18.2	4	17.4	6	17.6
ARNI	-	-	2	8.7	2	5.9
CI	1	9.1	5	21.7	6	17.6
Not documented	5	45.5	4	17.4	9	26.5
Beta Blocker						
BB	7	63.6	20	87.0	27	79.4

CI	3	27.3	3	13.0	6	17.6
Not documented	1	9.1	-	-	1	2.9

The process data measures were evaluated using CMS quality measures. CMS quality measures results were reported as an average of individual providers' performances for each measure. The providers participating in the CMS incentive program are included during the 2016 reporting period. NPs (N=134,464) were the largest group of providers participating in incentive programs. However, reporting was low at 14.7% (Table 4). The CMS results measures for comparison of this project were ACEi/ARB/ARNI/CI therapy 78.1 %, BB/CI therapy 83.1%, smoking cessation counseling 91.5 %, and blood pressure control 64.7% (Table 5).

Table 4

CMS Quality Reporting Participating Provider Types

Rank	Specialty or Provider Type	Eligible N	Participated N	%
5	Family Practice	115,536	24,511	21.2%
6	Nurse Practitioner	134,404	19,809	14.70%
7	Physician Assistant	93,496	19,280	20.60%

Table 5

PQRS Average Performance Measures

Measure Number	Measure Description	2015-2016 N	Average 2015	Average 2016
5	ACE/ARB LVSD	2,274	79.2%	78.1%
8	BB LVSD	1,734	82.2%	83.1%
226	Tobacco Screening and Cessation	80,717	90.3%	91.5%

236	Controlling High Blood Pressure	28,916	63.7%	64.7%

The clinical data abstracted included hospitalization and deaths. There were 17.6% hospitalizations documented 17.4 (n=6) and 2.9% (n=1) documented as deceased for clinical data (Table 6). This data was included as mortality and hospitalization are the clinical outcomes that provide evidence of improvements. This information reveals changes in the HF burden. Hospitalizations and deaths were topics beyond the scope of the QIP but important data to highlight.

Based on the literature, HF patients discharged from the hospital has higher mortality and 30-day readmission risks if not managed with GDMT as recommended.

Table 6

Clinical Outcomes (N=34)

Clinical		Clinic #1		Clinic #2		Total	
		n	%	n	%	n	%
Hospitalization							
	Yes	2	18.2	4	17.4	6	17.6
	No	9	81.8	19	82.6	28	82.4
Deaths							
	Yes	-	-	1	4.3	1	2.9
	No	11	100.0	22	95.7	33	97.1

Donabedian Framework and Measures Comparison

A comparison of CMS measures to the provider's process results was performed using Donabedian framework. According to the tenet of structure, chart encounters were evaluated and compared to CMS measures individually and with both clinics combined. The charts audit

sample (N=34) were broken down based on those with multiple (n=14) and single (n=20) encounters.

Clinic A had a larger number of multiple encounters while Clinic B had a larger number of single encounters. The process measures were compared between clinics which revealed Clinic B performed better in all measures except BP control which were 50% and 37.5% respectively. The combined total of both clinic outcomes was compared to CMS outcome measures. The clinics fell below all measures when compared to the CMS measures (Table 7).

Table 7

Comparison of Clinic and CMS Process Measure using Donabedian's Framework

		Single Encounters		Outcome		Multiple Encounters		Outcome		CMS
Structure	Clinic	A	B			A	B			
CDS	Chart	n=4	n=16	ND	N=20	n=30	n=23	ND	N=53	
Process Measure										
ACEI/ARB/ ARNI/CI		50	81.3	25	75	56.7	78.3	34	66	78.1
BB/CI		75	81.3	20	80	60.0	100.0	22.6	77.4	83.1
BP Control <140/90		50	37.5	-	40	43.3	39.1	-	41.5	64.7
Smoking Cessation		25	100	15	85	40	100	34.6	65.4	91.5

Note: ND not documented

Provider Questionnaire

Demographics of the providers were one male and one female within the age range of 45-54, both self-identified as Black. Both have advanced practice degrees: the male has a Doctor of Nursing Practice, and the female has a master's in the science of nursing (Table 8).

The following questions allowed the SI to examine the use and perceptions of clinical decision support tools in the outpatient setting (Appendix C).

1. Based on each provider's experience, the providers agreed that each clinic's EMR could allow the user to complete all the tasks provided listed on the questionnaire.

2. Both providers selected yes that CDS was embedded in the EMR at each practice.

3. Both providers responded with a pop-up or drop-down box versus an audible alert.

4. The providers responded that each system allowed a bypass of the CDS presentation without a required response.

5. The providers selected CDS tasks and ease of use: Clinic's A provider selected decisions with lab orders with a rating of 8, and prevention of adverse event, support with decisions for preventative care, patient education, and patient counseling and rated each a 10. Provider from Clinic B selected and rated all the tasks ten including support with procedures, medications, referrals, and scheduling follow-up.

6. Provider from Clinic A, selected four facilitators to CDS use: quality in healthcare commenting "due to CDS reminders", access to up to date knowledge commenting "gives information on guidelines and up to date", patient satisfaction with meeting their healthcare needs comments CDS "helps you to know what test to provide so patient is satisfied with care", and support for comprehensive patient care with comments "if there are things that are missed, the CDT helps us to know what is missing". The provider from Clinic B selected all options listed for facilitators to CDS to use and did not provide any comments.

7. The provider at Clinic's A commented that CDS use "does not interfere…use enhance judgment". Clinic's A provider selected the use of CDS prolonged

documentation of patient care and commented: "yes, but necessary documentation." The provider from Clinic's B did not choose any of the pre-populated barriers writing "nothing applies."

8. The provider from Clinic A selected use of CDS was sometimes commenting "sometimes use the tools if I glance at the notifications for the patient. The provider from Clinic B selected most times without any explanation.

9. Clinic's A provider, rated CDS satisfaction as a 2 and Clinic's B provider satisfaction of CDS was 8.

10. Providers' demographics information is noted above for each provider (Table 8).

11. Clinic's A provider selected knowledge level of CDS was an average user whereas Clinic's B provider chose an advanced user.

Table 8

Provider Demographics

Demographics	Provider 1	Provider 2
Gender	Male	Female
Age	45-54	45-54
Race	Black	Black
Hispanic/Latino	No	No
Educational Level	DNP	MSN
Knowledge Level of CDS	Average User	Advanced User

Discussion

Although the results of the quality improvement project suggest that the practitioners are not in-line with CMS quality measures, the results should be examined with some amount of

caution as this project did not control for variability in the data. The documentation frequency for the NPs fell below CMS measures. CMS data showed that ACEi/ARBs therapy was 78.1 %, BB therapy 83.1%, smoking cessation counseling 91.5 %, and blood pressure control 64.7%. Among the participating NPs, frequency results were ACEi/ARBs 55.9%, BB therapy 79.4%, smoking cessation counseling 47.1 %, and blood pressure control 41.2%. The GDMT documented within the charts was often not started or titrated by the NP. There was missing documentation for ACEi/ARBS in 26.5% of the charts. These findings are consistent with previous evidence as provider adherence is low, optimization of therapies difficult to determine, and incomplete documentation is problematic when evaluating the results. This practice of incomplete documentation is a concern as ACEi/ARBs have been shown to decrease hospitalizations which is a strong indicator to increase mortality (Valadri et al., 2017).

The rate of documentation of smoking cessation and high blood pressure among the NPs in the QIP was 47.1% and 41.2% respectively. As in previous evidence, results of preventative measures are insignificant and low, particularly in blood pressure management. High blood pressure is also a major risk factor for cardiovascular disease. Over 480,000 Americans die from the use of tobacco, and over 78,000 dies from high blood pressure (Benjamin et al., 2018). According to the American Heart Association, tobacco use increases the risk of cardiovascular disease and is a leading preventable risk factor of mortality (Benjamin et al., 2018).

The information obtained from the questionnaires suggests that documentation is a problem among NPs as completion of the questionnaire became a lengthy process. Documentation was often completed at the end of the day for one provider. One provider uses templates to cut-down on charting time. Based on the results of the CMS quality report, nurse

practitioners are in large numbers managing patients with chronic illness, however of the 134 thousand nurses able to transmit quality measures, only 14.7% NPs participated.

Limitations

The retrospective design of the QIP is a limitation. The convenience sampling of the charts may not be representative of the general population (Vassar & Holzmann, 2013). However, this method was suitable for the QIP as the NPs practices were small and did not produce the number of charts expected for review. Additionally, secondary data from chart review, possible loss of information, and inaccuracy in provider transcription are risks and threats to validity (Patawala, 2017).

Another limitation was only two NP practices participated in the QIP which increased the risk of generalizability issues (Vassar & Holzmann, 2013). Nevertheless, the results of this QIP highlighted problems in providers documentation which provides information for provider education and further research. The number of charts sampled was smaller than anticipated. The data from the final chart sample provided the SI with preliminary results for implications for future inquiry.

Risk of bias was a limitation related to the exclusion of left ventricular ejection function, and the classification of heart failure as both are important values to consider when initiating GDMT in HF (Yancy et al., 2017).

Also, unverifiable missing and incomplete data were limitations (Worster, 2004). This missing data may have skewed the results and difficult to compare to CMS National measures. The SI selected to keep the charts because deleting the charts would have decreased the sample and created an increased bias (Worster & Haines, 2004). The SI used missing data as a variable for post hoc improvement.

The providers' answers to the questionnaire were mostly limited to a check mark and minimal comments which would have given the SI greater information to provide a robust evaluation. Although both practices have EMRs embedded with CDS, both NPs states that CDS was not used with each patient contact. The CDS were enabled in both EMRs. However, it was difficult to access use with HF management retroactively. Documentation of process measures was also difficult to discern at what point of patient contact occurred. Given this, it is difficult to establish any impact CDS could have had with NPs management of HF patients.

Summary and Applicability to Practice

The burden of heart failure is well-known in the literature. It affects over 6 million Americans, the cause of over a million hospitalizations annually, and is associated with increased mortality. The use of GDMT has shown to improve the quality of life of those affected and decrease hospitalization and mortality. Nurse practitioners, as first-line providers, must be able to manage these patients with GDMT effectively.

Advance Practice Nurse Implications. NPs are competent, well-qualified providers to provide care to individuals with multiple healthcare needs (Bardach et al., 2013). Furthermore, the primary care provider plays an essential role in outpatient heart failure management. The results of a large trial by the Veteran Administration (VA) supports NPs in providing quality services by showing that NP-led clinics in rural areas had a reduction in hospital admissions and mortality in heart failure patients while decreasing costs and filling the gap in healthcare services (Lowery et al., 2012). Optimization of GDMT requires frequent close monitoring of vital signs, volume status, and laboratory findings. Frequent cardiology visits are usually less practical than visits to the primary care office. NPs in primary care must be empowered to initiate, titrate, and manage GDMT to improve healthcare outcomes (Valadri et al., 2017).

Failure to meeting quality indicators and CDS recommendations can have various implications. Missing or incomplete documentation can lead to penalties from CMS and skew results of evidence-based studies (Austria, 2015). Non-compliance of quality indicators may support allegations of negligence. Inaccurate claim codes can result in monetary loss and lead to charges of fraud (Austria, 2015).

Patient Implications. Patient safety is compromised due to incomplete or poor clinical practices. Failure to optimize GDMT can worsen HF-related symptoms and outcomes leading to patient injury, death, and malpractice claims (Austria, 2015). Furthermore, inadequate clinical practices can lead to decreased patient satisfaction and confidence.

Policy Implications. Current Regulatory and scope of practice policies limit o clinical practices delivered by NPs. Clinical practice failures may support increased limitations and more stringent policies for NPs seeking independent practice (Austria, 2015). Likewise, current reimbursement models reimburse NPs at lower rates than physicians for the same clinical services and claims codes. The results of inaccurate coding may lead to no reimbursement or fraud and incomplete documentation to imposed penalties for low performance (Austria, 2015). CMS will assess penalty fees to providers who care for Medicare and Medicaid patients and do not achieve quality measures goals (CMS, 2018).

Conclusion

The evidence provides data about provider differences, educational support and clinical management incentives that affect adherence to CDS, GDMT and HF outcomes. NPs must increase their knowledge of CDS by utilizing educational and technical support to become more confident in managing complex patients and compliance of GDMT (Walsh et al. 2010).

CDS are support tools to influence the providers to deliver evidence-based therapies. However, a critical gap between guidelines and practice is provider adherence. More evidence is needed targeting NPs as most articles reviewed in this QIP targeted physicians or physician practices. Stronger evidence supporting NPs use of CDS when managing HF in the outpatient setting is vital to help decrease morbidity and mortality in this population because the HF burden is forecast to increase (Komanduri et al., 2017).

The NPs in this QIP would benefit in further education on CDS, GDMT, CMS quality measures for improved management and documentation of HF patients. Innovative designs for educational and technical support are important for provider engagement and acceptance of CDS when treating heart failure patient (Walsh et al. 2010). CDS are valuable tools for providers that can have a positive influence on disease management health outcomes in the outpatient setting (Arts, at al., 2017; Peiris et al., 2015; Anchala et al., 2012; Walsh et al., 2010; Gill, 2009).

Dissemination

The plan for dissemination of this QIP includes a formal presentation to defend to the DNP staff, colleagues, and team members. Also, the SI will deliver a formal presentation to the two clinics that participated in the project. An abstract was accepted to be included the Annual Lewis College Graduate Research Conference. Finally, a post hoc case study to educate NPs in the community regarding using CDS in heart failure management and outcome improvements and submit a case study for publication.

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Appendix A: Review of Literature Matrix

Review of Literature Matrix

Author	Design	Country	Sample	Measurement	Results	Target	Strength
Arts et al., 2017	RCT	Netherlands	N=731 PCP clinic	Provider adherence with CDS; document reason for non-adherence	Low use of CDS; noted reason, non-capture -Barriers: lack of time, too may alerts, limitation in system function	Provider Afib	Ia
Valadri et al., 2017	OBS	U.S.	N=155	Provider adherence GDMT in HF	Low Optimization of GDMT -PCP reluctant d/t possible cardio-renal imbalances	Provider HF	IIIa
Crissinger et al, 2015	OBS	U.S.	N-641 307 HF, 258 CV, and 76 PCP.	Differences in GDMT therapy among provider types: PCP, CV, HF team	HF teams adhered most often target and optimal therapies -PCP low adherence	Patient HF	IIIb
Peiris, et al., 2015	RCT	Australia	N=60 outpatient clinics: 30 community/ 30 GP	CDS QI effect on CVD risk management and prescription rates	Positive effect on CVD preventative management; no effect on prescription rates	Provider CVD	Ia
Mitchell, et al., 2014	OBS	U.S.	N=2335 hospitals	CDS effect on 30-day admission and CMS process HF measures	Positive correlation with CDS on 30-day readmission rates; no correlation with CMS HF measures	Clinical Provider HF	IIIa
Connelly, et al., 2012	OBS	US	N=5166 3 ED	EMR effect on hospitalization, LOS, inpatient mortality	2/3 lower mortality, 1/3 lower hospitalization, 1/3 prolonged ED stay; however, decrease procedure/labs orders	Clinical Provider HF	IIIa
Raghupathy et al., 2012	SR-MA	Multiple	N=10	CDS effect on prevention of CVD, HF, TIA/CVA and CAD	Variable results on prevention: no effect on HF; increased on TIA/CVA w/o impact; HF improved processes at cost of increased readmission rates; 30% reduction AMI; however, no differences between groups on mortality or readmission	Patient CVD	IIb
Walsh et al., 2010	OBS	U. S	N=167 Outpt Target: HF PT	EHR vs paper: on CMS quality measures	CDS with moderate effect measures: ACEi/ARB/BB	Provider HF	IIIa
Pearson et al., 2009	SR	Multiple	N=56 50-RCT 6-Quasi-exp	Impact CDS on prescribing practices in inpt vs outpt setting	16 related to CVD- 4 showed positive impact on majority of outcomes	Provider CVD	IIa
Gill et al., 2009	RCT	U.S.	N=25 12 I 13 C	CDS effect on lipid testing, goals and # of prescription	Lipid testing increased LDL-C goal increased Increased # of prescriptions. No differences among groups	Provider CVD	Ia
Bryan & Boren, 2008	SR	US	N=17: 12RCT 5-NRCT	CDS effect healthcare outcomes	13-positive or variable outcome; 4- no significant outcome	Provider Patient CVD Depression	IIa

Appendix B: Chart Audit Tools

Table B1: Abstraction Tool

Data Abstraction Tool

MRN	DOB	Age	Sex	Ethnicity	Diagnosis ICD10	# Co-morbid conditions	Blood pressure	Clinical symptoms	Smoking cessation	ACE*or ARB or ARNI, and BB	Hospital Stay Deceased
Clinic record	00/00/00		M/F	-American Indian -Asian -Hawaiian/ Pacific Islander -Black -White -Other	ICD 10 code sheet	0-2 3-4 ≥5	<140/90	Dyspnea Fatigue, Edema Orthopnea Pulmonary rales JVD* Hepatomegaly	Yes or no	-Prescribed -Not prescribed CI* Intolerance Refused	H= y/n D= y/n

*CI- contraindicated, JVD-Jugular venous distention, ACE- Angiotensin converting enzyme inhibitor, ARB-angiotensin receptor blocker, BB-beta blocker

Table B2: Abstraction Tool Code Sheet

CODES	DESCRIPTION
DYSPNEA	
J80	Acute respiratory distress syndrome
R06.00	Dyspnea, unspecified
R06.01	Orthopnea
R06.02	Shortness of breath
R06.09	Other forms of dyspnea
R06.89	Other abnormalities of breathing
R06.9	Unspecified abnormalities of breathing
FATIGUE	
G93.3	Post viral fatigue syndrome
R53.0	Neoplastic (malignant) related fatigue
R53.1	Weakness
R53.81	Other malaise
R53.83	Other fatigue
EDEMA	
R60.0	Localized edema
R60.1	Generalized edema
R60.9	Edema, unspecified
HEART FAILURE	
I50	Heart failure
I50.9	Heart failure, unspecified; Biventricular (heart) failure NOS; Cardiac, heart or myocardial failure NOS; Congestive heart disease; Congestive heart failure; Right ventricular failure (secondary to left heart failure)
I50.1	Left ventricular failure; Cardiac asthma; Edema of lung with heart disease NOS; Edema of lung with heart failure; Left heart failure; Pulmonary edema with heart disease NOS
I50.20	Unspecified systolic (congestive) heart failure
I50.21	Acute systolic (congestive) heart failure
I50.22	Chronic systolic (congestive) heart failure
I50.23	Acute on chronic systolic (congestive) heart failure
I50.30	Unspecified diastolic (congestive) heart failure
I50.31	Acute diastolic (congestive) heart failure
I50.32	Chronic diastolic (congestive) heart failure
I50.33	Acute on chronic diastolic (congestive) heart failure
I50.40	Unspecified combined systolic congestive) and diastolic (congestive) heart failure
I50.41	Acute combined systolic (congestive) and diastolic (congestive) heart failure
I50.42	Chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50.43	Acute on chronic combined systolic (congestive) and diastolic(congestive) heart failure
I50.1	Left ventricular failure; Heart failure, unspecified; Biventricular (heart) failure NO Cardiac, heart or myocardial failure NOS; Congestive heart disease; Congestive heart failure; Right ventricular failure (secondary to left heart failure

Appendix C: Provider Questionnaire

Clinical Decision Support Tools Survey

Instructions

When completing the questionnaire, you may leave blank any questions that you do not want to answer. We will keep your responses strictly confidential. This questionnaire has been designed to gather information about your perceptions on the use of clinical decision support tools among nurse practitioners in the outpatient setting.

Based on your experience, which tasks are you able to complete within the medical record?

Choose all that apply	
Obtain and review patient information and data	
Document care for my patients	
View lab tests for my patients	
Prevent adverse events (e.g., drug-drug interaction, drug-allergy interaction)	
Track preventive care for my patients	
Manage chronic disease conditions for my patients	
Manage orders	
Manage referrals	
Provide patient educational materials	

Does your electronic medical record include clinical decision support tools?

- ☐ Yes
- ☐ No

If so, in what format does the clinical decision support tools presented within the electronic medical record?

- ☐ Pop-up or drop-down box
- ☐ Audible alert

Based on the format of the software for the clinical decision support tool, is there a requirement to respond or are you allowed to bypass the presentation?

- ☐ Required response
- ☐ Bypass

Based on your knowledge of clinical decision support tools, which tasks do you use clinical support tools when managing patients? Rate the ease of completing each task on 0-10 scale

Choose all that apply	√
Decisions with lab orders	
Decisions procedure orders	

Decisions with medication order	
Prevent adverse events (e.g., drug-drug interaction, drug-allergy interaction)	
Decisions with preventive care for my patients	
Decisions with referral	
Decisions with patient education, such medication	
Decisions with patient counseling	
Decisions with follow-up timing	

Based on your experience, identify and discuss factors that facilitate the use of clinical decision support tools within your practice?

Choose all that apply	√	Explain
Costs of providing care		
Quality of health care		
Stress-level		
Provider and patient communication		
Access to up- to-date knowledge		
Patients' satisfaction with meeting their healthcare needs		
Your ability to manage more complex problems		
Providing comprehensive of patient care		
Efficiency of clinical practice		
Avoiding errors (such overlooking a drug)		

Based on your experience, identify and discuss any barriers that prevent the use of clinical decision support tools?

Choose all that apply	√	Explain
Use interferes with patient interaction.		
Use has increased my workload.		

Use does not enhance my judgment when managing a patient.		
Use prolongs documentation of patient care.		
Other		

Based on your experience, please indicate how often you use clinical decision support tools in your practice as a nurse practitioner? Explain		√
Every time		
Most times		
Sometimes		
Not at all		
N/A		

Rate your satisfaction with clinical decision support tools on a scale from 0-10 ☐

Tell me about yourself						
Gender	Male	Female				
Age	34 or less	35-44	45-54	55+		
Hispanic/Latino	Yes	No				
Race	American Indian	Asian	Native Hawaiian or Pacific Islander	Black African American	White	Other: (specify) _____
Highest Education Level	High School or GED	2-year college degree (Associate)	4-year college degree (BA, BS, BSN, etc.)	Master's degree (MA, MS)	Doctoral degree (Ph.D., DNP, etc.)	Professional degree (MD, PharmD)

Choose the best description of your knowledge of clinical decision support tools	√
Novice (newly acquired knowledge)	

Average user (knowledge of clinical decision support tools to manage patient and complete documentation)	
Advanced user (Knowledge to adjust clinical decision support tools based on your preferences)	
Expert user (Knowledge to set up and develop clinical decision support tools within the electronic medical record)	

Thank you for completing this questionnaire. This information will help us better understand the use and perceptions of clinical decision support tools among nurse practitioner in the outpatient setting.

Appendix D: Timeline

Timeline

Task	Apr 2018	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 2019	Feb	Mar	Apr
Proposal Approval	x												
Proposal Presentation	x												
IRB apply					x								
IRB approval					x								
Consent to Providers						x							
Interview with providers						x							
Chart review						x	x						
Evaluation							x						
Analysis of outcomes								x	x				
Results to team									x	x			
Pre-Defense Paper										x			
Dissemination Plan											x		
Final paper to Team											x		
Abstract Submission											x		
Defense												x	
DNP Project Manuscript												x	
DNP Final Post Defense													x
Complete IRB Closeout													x