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EVALUATION OF THE PRODUCTIVE EFFICIENCY OF NURSE PRACTITIONERS IN A NURSE MANAGED CENTER IN A HIGHLY RESTRICTIVE SCOPE-OF-PRACTICE STATE

by

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A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham,
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Doctor of Science in Health Services Administration

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FARAZ S. AHMED

ADMINISTRATION – HEALTH SERVICES

ABSTRACT

The purpose of this study is to determine the productive efficiency of Nurse Practitioners (NP) in a Nurse Managed Center (NMC) in a highly restrictive Scope-of-Practice (SOP) state. NPs are skilled, cost effective and quality health care providers and are considered a highly competitive option for increasing access while reducing health care costs. However, it is not clearly known if NPs are the most productively efficient at delivering this reduced cost of health care.

The theories of Complex Adaptive Systems (CAS) and Resource Based View (RBV) were used as a framework to develop the hypotheses that examined the productive efficiency of NPs. The research question of this study is "Which factors within the daily practice of NPs contribute to the productive efficiency in NMCs?" The study included the following variables: 1) Time for the NP to Assign CPT Code, 2) Additional Number of Secondary ICD Codes, 3) Patient Residency Status, 4) Age, 5) Gender and 6) Years of Experience for the NP. Data were collected from a NMC that is located in a state with highly restrictive SOP laws, employs only NPs and provides the full spectrum of primary care services.

Years of Experience for NP was associated with lower times, Additional Number of ICD codes was associated with longer times and Gender was associated with lower times.

This is consistent with the theories of CAS and RBV, where it is theorized that numerous factors are involved in creating an environment where efficiency can be achieved and competitive forces sustained. Furthermore, as these environments undergo change they affect other environments and thus, affect the productive efficiency of those other environments. This clarity can then be used with the theory of RBV to apply advanced and sophisticated allocation of resources to achieve the most efficient outcome possible, with an understanding that this allocation may have to be changed based on the situation at hand. This knowledge has implications for policy makers, payors, practitioners and administrative leadership.

Keywords: Nurse Managed Center, Nurse Practitioners, Scope-of-Practice, ICD and CPT Code, RVU, Time to Assign Code

DEDICATION

First and last, this study is dedicated to Sylvia. For the past, the present and the future. Thank you.

Second, this study is dedicated to the rest of my family. Thank you for "tolerating" my habits and dreams over many number of years, particularly, over the last three years. There's more to come.

From my first family to my second family, I won the family lottery. Twice.

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To my cohort: Let's do this again. That is, let's do the dinners, drinks, fires, midnight snow ball fights, gay rights parade, missed flights, international exploration and

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CHAPTER 1

INTRODUCTION

The focus of many efforts in reforming health care is to increase the productive efficiency of each step among all individuals involved in delivering health care. One such effort is to determine how best to deploy and use the limited resources of human capital while striving to attain the goals of increased access, high quality care, and low cost per capita.

Nurse practitioners (NP) are a vital source of human capital that can help attain these goals. Numerous studies have outlined the patient experience, cost savings and quality outcomes of NP care in various settings including urban, rural, ambulatory, and acute care (Benkert et al., 2007; Byrne, Richardson, Brunsdon, & Patel, 2000; Chenoweth, Martin, Pankowski, & Raymond, 2008; Fanta et al., 2006; Jennings, Lee, Chao, & Keating, 2009; Kutney-Lee et al., 2009; National Nursing Centers Consortium, 2011; Shum, Humphreys, Wheeler, Cochrane, & Clement, 2000). In many settings, NPs have contributed to improving chronic disease management and population health. Researchers have noted that the costs to train and compensate NPs are lower than those of physicians, which provides a worthwhile alternative when considering the needs of the future health care workforce. Furthermore, the scope-of-practice (SOP) of NPs spans all aspects of health care, making them readily deployable across multiple settings and thus, able to contribute to increased access and high quality care.

The first expanded role for nurses as advanced practice providers of health care was in Colorado in 1965; this role was envisioned as a collaborative relationship between physicians and nurses. Currently, there are approximately 14,000 new NPs graduating annually (American Association of Nurse Practitioners, 2014). The goal in 1965 was "not to relieve the physician shortage or to substitute for physicians" but rather to add value and quality to the care of pediatric patients in rural settings (Weiland, 2008). Nearly 50 years later, the original, innovative, collaborative, and open approach has been re-conceptualized by both parties (i.e., nursing and medicine) vying for the protection of their professional autonomy, scope-of-practice and financial territory. These opposing forces are exemplified by the economic self-interests of physicians, nurse practitioners, other health care providers, payors, professional associations, legislators, and more. All of these entities are lobbying for enhancements or continued restrictions, and at times, even an expansion of restrictions on the independent practice rights of nurse practitioners.

In the meantime, positive quality outcomes from the work of NPs have been noted by a number of researchers in various clinical procedures and in various practice locations. For example, NMCs (Barkauskas, Pohl, Tanner, Onifade, & Pilon, 2011; Benkert et al., 2007; Pohl, Barkauskas, Benkert, Breer, & Bostrom, 2007), emergency departments (Byrne et al., 2000; Ducharme, Alder, Pelletier, Murray, & Tepper, 2009; Hooker & McCaig, 1996) and acute care (Cowan et al., 2006; Hoffman, Tasota, Scharfenberg, Zullo, & Donahoe, 2003; Rudy, Davidson, Daly, & Clochesy, 1998; Russell, VorderBruegge, & Burns, 2002).

Between 1990 and 2000, researchers demonstrated that a local hospital saved $13.9 million due to a drop in uninsured Emergency Department (ED) visits after a

nearby health center was opened and operated by NPs (Coddington & Sands, 2008). Furthermore, the research literature also shows no difference in care between NPs and physicians (Fairman, Rowe, Hassmiller, & Shalala, 2011; Institute of Medicine, 2010). In fact, a systematic review of NP outcomes, published in studies between 1990 and 2008, showed positive quality outcomes in patient satisfaction, patient health status, functional status, and ED usage when care was provided by NPs, Clinical Nurse Specialists (CNS), Certified Nurse Midwives (CNM) or Certified Registered Nurse Anesthetists (CRNA). A summary of this literature review can be found in Table 1 (Newhouse et al., 2011).

Nurse Managed Centers (NMC) have been in existence since the late 19th century as employment locations for NPs and as a setting for NPs to practice as independently as allowed by the SOP laws; a NMC will serve as the data collection site for this current investigation. Historically, NMCs were defined as entities that were expected to address issues related to housing, food, sanitation, security, communicable diseases, and more, in addition to providing health care (Holt, Zabler, & Baisch, 2014). A modern day NMC is defined as an organization in which NPs provide primary care services in an ambulatory environment.

In 1987, the American Nurses Association (ANA) adopted a more formal definition which has, since, become the standard definition of NMCs. The ANA defines NMCs as a practice setting that is nurse-led and where services are holistic and client-centered (Aydelotte et al., 1987). Even within this contemporary definition of NMCs, it can be seen that, managing the social determinants of health, a time intensive activity, is still an integral part of the practice patterns of NPs.

There are approximately 250 NMCs that are currently operating in the United States. Of these, 160 identify themselves as "wellness centers" and provide limited care. The remaining 90 provide comprehensive primary care services. The majority (74%) of these comprehensive primary care sites are affiliated with schools of nursing at academic institutions; the remaining 26% are independent, non-profits, or hospital-based outpatient clinics (National Nursing Centers Consortium, 2011).

Generally, NMCs are located on or near college or university campuses and are affiliated with schools of nursing. The rationale for a school of nursing to host a NMC is three-fold: (1) To provide an environment in which a holistic approach to nursing can be taught and where future nurses can learn their trade; (2) To provide care to the community, including the underserved, chronically ill, and uninsured or underinsured and thereby continuing the service tradition of nursing; and (3) To capitalize on the interest in establishing practice plans for nursing faculty that was spurred by the availability of grants from the Health Resources and Services Administration (HRSA), for establishing NMCs (Clear, Starbecker, & Kelly, 1999).

The support for new grants for training NPs and establishing NMCs was recently renewed under a provision of the Affordable Care Act (ACA). Moreover, ACA administrators and other researchers, have identified NMCs and NPs as an effective, but underutilized, resource for expanding primary care, which supports national goals for increasing access, value, and quality (Bauer, 2010; Holt et al., 2014). Nurse Managed Centers have been called "disruptive innovations" because they "enable less expensive professionals (NPs) to do progressively more sophisticated things in less expensive settings" (Christensen, Bohmer, & Kenagy, 2000). Lastly, by legislative sanction, the

ACA lends further credence to the NMC and NP practice model by including a definition in the statute that is more prescriptive and specifies services, target populations, and organizational affiliations (Patient Protection and Affordable Care Act, 2010).

Currently, most of the NMCs rely on funding from their respective schools of nursing, grants, and donations. According to the experts, "Nearly half of all major managed care insurers don't reimburse NPs as primary care providers" (Hansen-Turton, Bailey, Torres, & Ritter, 2010). In fact, the majority of NMCs are not financially self-sufficient (Mackey & McNeil, 1997). If the business model of an NMC does not lend itself to creating a self-sufficient financial structure, these NMCs often close once their grants are exhausted. Indeed, it has been predicted that schools of nursing will soon have to close their NMCs or significantly reduce their financial commitments to them (Barger, Nugent, & Bridges, 1993). One estimate shows that more than half of NMCs have closed over the past 20 years (King, 2008). With the mounting budgetary pressures on academic institutions, schools of nursing are becoming less able to support such financial commitments. Furthermore, many NMCs cannot transition into a Federally Qualified Health Center (FQHC) status because their existing ownership structure is incompatible with FQHC rules and regulations and, thus, NMCs fail to qualify for cost-based reimbursement.

This lack of reimbursement for services, often linked to highly restrictive SOP laws, is another significant obstacle to the sustainability of NMCs and NPs. This challenging environment requires the NMCs and NPs to function within a complex structure consisting of variables such as; constraints on SOP, limited and unequal reimbursement, increased utilization in a resource intensive industry, variable human

resource capital and patient populations - all the while, having to maintain a system wide and holistic perspective. These statistics demonstrate the financial and operational challenges faced by NMCs and NPs.

Significance of the Study

Despite compelling evidence listing the effectiveness of health care delivered by NPs, the lower cost of health care delivered by NPs and the quality outcomes achieved from health care delivered by NPs, the knowledge of productive efficiency in delivering such care by NPs is lacking. Therefore, the purpose of this study is to determine the level of productive efficiency of NPs in a NMC in a highly restrictive SOP state. Understanding the extent to which productive efficiency of NPs in this setting can affect the allocation of resources may lead to a more focused deployment of limited human capital. The findings from this study may benefit the following groups:

Policy Makers

Legislators can use the results to better forge alliances with providers and policy advocates to meet the needs of disparate constituencies. Reducing barriers to primary care could lead to greater access and reduced medical expenditures incurred by the state enhancing both the economic interests and public interests of legislators. Expanded knowledge in the practice patterns and value of NPs would provide a model for financial stability and viability. Such a model would also offer increased economic incentives for NPs to locate in communities that are not urban, rural, or underserved – as these are the locations where NPs typically practice.

Academic Institutions

This research may be beneficial to the leaders of academic institutions, particularly institutions in which schools of nursing sponsor, and possibly subsidize, the local NMC. One type of a NMC, is a campus health center, that can reduce or eliminate the need for a subsidy by providing the university support for the NMC, while still, providing quality care and achieving financial viability and independence. This type of NMC would be an attractive recruitment tactic for academic leaders and a safety net for students while also providing an economical health care venue for college students that tax payors might support.

Public Health Policy Advocates

NPs provide care to a large number of uninsured, low income, homeless, and racial and ethnic minorities (Hansen-Turton, 2005). For example, one report indicates that 22% of homeless individuals are more likely to remain compliant with TB treatment under the NP model than the physician model (Nyamathi et al., 2008). Medicare expenditures for its beneficiaries with five or more chronic conditions increased 24% between 1987 and 2002 (Bodenheimer & Berry-Millett, 2009). Public health advocates can employ this data to support the larger public health protection goals by using a NP model of care.

Retail Clinics

Retail chains (e.g., Wal-Mart, Target, Walgreens, CVS, Urgent Care Centers, etc.) already provide limited health services using NPs. These services remain limited due to:

highly restrictive and varying scope-of-practice laws (SOP), inability to determine and apply standardized productivity protocols, and inconsistent reimbursement policies from individual state Medicaid agencies (Yee, Boukus, Cross, & Samuel, 2013). Figure 1 provides an overview of the complexity and variety in SOP laws across the United States (Kaiser Family Foundation, 2014). A consistent NP practice model would provide an economic and public service incentive for retailers to fully participate in the health care sector and thus, leverage their existing coverage areas, experience, and proficiency in retail marketing to increase health care access to the citizenry.

The Elderly

By 2030, the youngest members of the baby-boomer generation will reach the age of 65, and the number of elderly in the United States will have increased from 12% to 20%. Presently, this 12% of the population utilizes 26% of physician office visits, 35% of hospitalizations, and 34% of all prescriptions written (Voelker, 2008). The near doubling these utilization numbers, while also recognizing that NPs provide a higher percentage of care to this population than physicians, provides sufficient justification for expanding the role of NPs. Particularly, when we consider that, since there has been a 22% decline in the availability of geriatricians since 2000 due to reduced reimbursement from Medicare and reduced training opportunities for providers (Voelker, 2008). There is a large economic interest for this concentrated group of individuals and a vocal demand to meet their needs and strong support for NPs as a primary care provider of choice (American Association of Retired Persons, 2010; Fairman et al., 2011).

Research Question

Which factors within the daily practice of NPs contribute to the productive efficiency in Nurse Managed Centers?

Plan of Work

Chapter Two provides a review of the literature relevant to NMCs, NPs and the theoretical framework that directed this study. This will include a review on the education, training, licensure, practice and reimbursement issues facing NMCs and NPs. This chapter will conclude with a review of the theoretical frameworks of Complex Adaptive Systems (CAS) and Resource Based View (RBV). This chapter will also outline how these two theories apply to the study of NMCs and NPs and how they informed the research question and the hypotheses.

Chapter Three presents the research question and the hypotheses that will be tested. This will be followed by a description of the data source and the sample population, identification of the operational variables and the outline of the research methodology developed to test the hypotheses.

Chapter Four will present the findings of the study.

Chapter Five will begin with a review and assessment of the findings. These findings will then be applied to potential recommendations for management, policy makers and for future research. This chapter will close by noting the limitations of this study and provide a summary of the dissertation project.

Table 1
Selected Findings from Systematic Review of NP Outcomes

NP* and physician outcomes are similar for the following:

Outcome Measurement	Number of RCT Studies	Level of Evidence
Pt. satisfaction with provider/care	6 (4 RCT)	High
Self-report of perceived health status	7 (5 RCT)	High
Functional Status	10 (6 RCT)	High
Blood Glucose	5 (5 RCT)	High
Blood Pressure	4 (4 RCT)	High
ED Visit	5 (3 RCT)	High
Hospitalization	11 (3 RCT)	High
Mortality	8 (1 RCT)	High
Length of stay	16 (2 RCT)	Moderate
Duration of ventilation	3 (0 RCT)	Low
Management of serum lipids	3 (3 RCT)	High

* Nurse Practitioner

CNM* and physician outcomes are similar for the following:

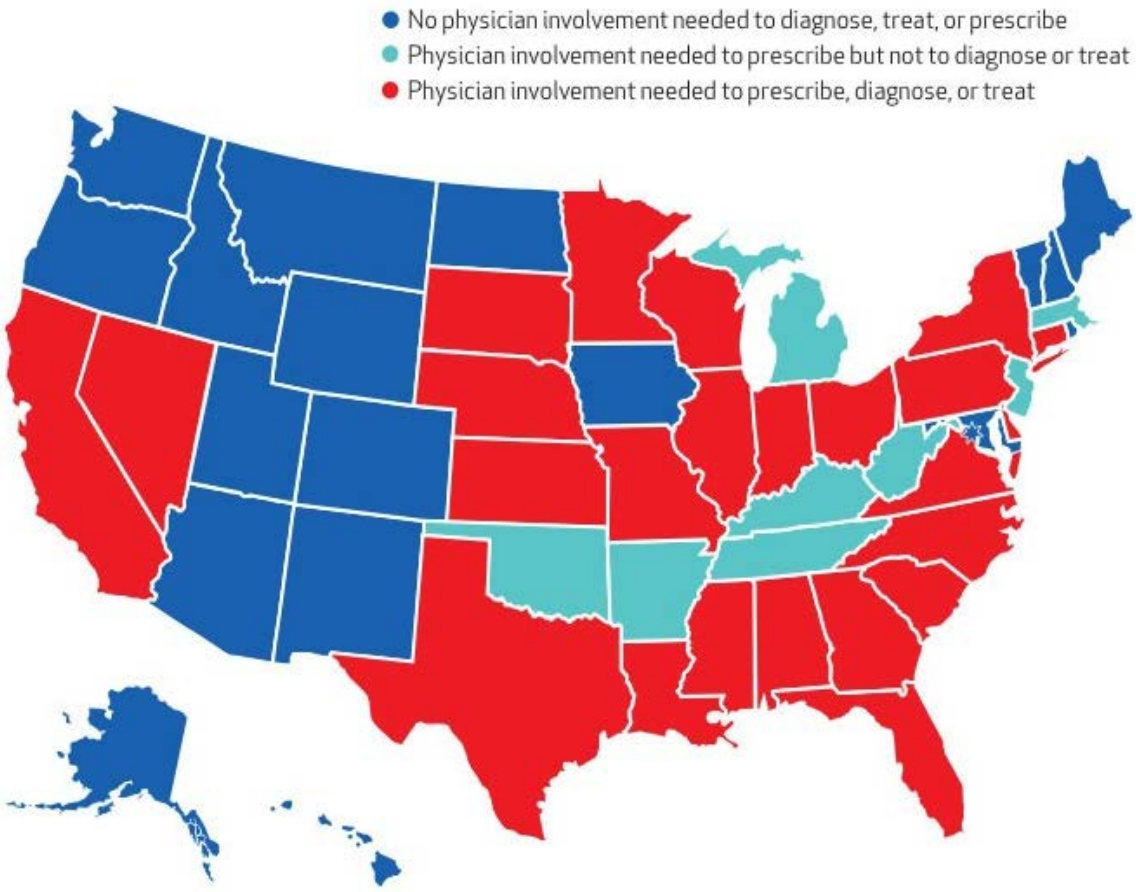
Outcome Measurement	Number of RCT Studies	Level of Evidence
Apgar scores	11 (1 RCT)	High
Low birth weight	8 (1 RCT)	High

* Certified Nurse Midwives

CNS* outcomes compared with non-CNS groups are the following:

Outcome Measurement	Number of RCT Studies	Level of Evidence
Inpatient length of stay comparable or lower	7 (2 RCT)	High
Inpatient costs comparable or lower	4 (2 RCT)	High
Complications comparable or lower	3 (1 RCT)	Moderate

* Certified Nurse Specialist



Note: From Linda J, Pearson, The 2012 Pearson Report. Copyright 2012 by Linda J. Pearson. Reprinted with permission. An updated copy this report can be found at http://nursing.jbpub.com/pearsonreport/

Figure 1. Scope of Practice Laws for NPs Across the United States.

CHAPTER 2

LITERATURE REVIEW

The literature is replete with qualitative and quantitative studies showing the benefits of care provided by NPs, the challenges they face, particularly, in their abilities to acquire reimbursement and defend their professional autonomy and, SOP territory from other providers of health care. This literature review will provide additional information from the frameworks of Complex Adaptive System (CAS) and Resource Based View (RBV) theories.

Definitions of Efficiency

Health care costs have been steadily on the rise for a number of years in the United States, and inefficiency is widely believed to be one of the main causes (Agency for Healthcare Research & Quality, 2012). Thus, gaining efficiency has long been a goal of practitioners and administrative leaders of health care. Over the last several years, health care providers and leaders have become mindful of metrics in quality measurements. However, with the advent of new payment systems such as, value-based purchasing and the focus on population health management, efficiencies in the provision and coordination of care are also gaining prominent attention.

Efficient allocation of resources is essential to the survival of any enterprise, from complex environments such as, health care to the less complex. Economists identify

three different types of efficient allocation of resources: (1) Technical Efficiency, (2) Allocative Efficiency, and (3) Productive Efficiency. Technical efficiency is defined as "a maximum set of outputs from a given set of inputs" (Zhang, Unruh, & Wan, 2008). Within the context of health care, technical efficiency may be considered the relationship between labor (input) and a health outcome (output) (Worthington, 2004). Allocative efficiency is defined as "the most efficient combination of inputs given their prices and production technology" (Zhang et al., 2008). Within the context of health care, allocative efficiency may be considered the combination of different technical tests (input) to produce maximum outcomes (outputs) (Worthington, 2004). Productive efficiency is defined as the point where "technical and allocative efficiency exist" (Zhang et al., 2008).

To productive efficiency, economists add another component, X-efficiency, to account for the complexities of various environments. X-efficiency is defined as the "maximum effective use of inputs due to internal motivational and external environment and market pressures" (Zhang et al., 2008). X-efficiency differs from technical efficiency in that it recognizes that there are other factors in a complex environment which may be the cause of the inefficient use of inputs, other than the apparent or basic technical or allocative inefficiencies (Zhang et al., 2008).

Definitions of Efficiency by Health Care Stakeholders

In addition to considering economic definitions of efficiency, definitions of efficiency in health care are provided in relation to various stakeholder groups. The Institute of Medicine (IOM) cautions about waste, the Ambulatory Quality Alliance (AQA) focuses on cost, the Government Accountability Office (GAO) highlights the

sufficiency of services to meet the patient's needs and the Medicare Payment Advisory Commission (MedPAC) recommends fewer input units to achieve equal or better output.

Selected definitions from various stakeholders are listed in Table 2 (Agency for Healthcare Research & Quality, 2008).

Table 2
Definitions of Efficiency from Selected Health Care Stakeholders

Stakeholder	Definition of Efficiency
Institute of Medicine (IOM)	Avoiding waste, including waste of equipment, supplies, ideas, and energy.
Ambulatory Quality Alliance (AQA)	A measure of the relationship of the cost of care associated with a specific level of performance measured with respect to the other five IOM aims of quality.
Government Accountability Office (GAO)	Providing and ordering a level of services that is sufficient to meet patients' health care needs, but not excessive, given a patient's health status.
Medicare Payment Advisory Commission (MedPAC)	Using fewer inputs to get the same or better outcomes. Efficiency combines concepts of resource use and quality.

The National Quality Forum (NQF) further expands the definition of efficiency and resource use to include the IOMs five aims of: quality, safety, timeliness, effectiveness and patient centeredness. Moreover, time is one of many factors comprised in defining efficiency. Figure 2 summarizes how and where time fits into the definition of efficiency by NQF (National Quality Forum, 2012).

Note: From "Cost and Resource Use Measures" by National Quality Forum. Copyright 2012 by National Quality Forum. Reprinted with permission.

Figure 2. Resource Use as a Building Block Toward Efficiency and Value

WHAT IS A NURSE PRACTITIONER?

The American Association of Nurse Practitioners (AANP) defines NPs as professionals who are qualified and licensed to diagnose and treat acute and chronic conditions, order and interpret test results, and prescribe medications and other treatments as necessary. According to AANP, the following characteristics describe the modern day NP, whose numbers currently exceed 171,000 in the United States (American Association of Nurse Practitioners, 2014).

1. An estimated 14,000 new NPs completed their academic programs in 2011-2012.
2. 93% of NPs have graduate degrees.

3. 97% of NPs maintain national certification.
4. 18% of NPs practice in rural or frontier settings.
5. 88% of NPs are trained in primary care; 68% of NPs work in at least one primary care site.
6. 87% of NPs see patients covered by Medicare and 84% by Medicaid.
7. 43% of NPs hold hospital privileges; 15% have long term care privileges.
8. 97.2% of NPs prescribe medications, averaging 19 prescriptions per day.
9. NPs hold prescriptive privileges in all 50 states and D.C., with privileges for controlled substances in 48 states.
10. The 2011 mean, full-time NP base salary was $91,310, with average full-time NP total income of $98,760.
11. 60% of NPs see three to four patients per hour; 7% see over five patients per hour.
12. Malpractice rates remain low; only 2% have been named as primary defendants in a malpractice case.

Educational Qualifications of a Nurse Practitioner

A NP is a registered nurse with at least a clinical-Master's degree as well as a national certification in a specialty area. It takes 6 years to educate and train a NP. This does not include the 5 to 7 years in nursing clinical practice directly related to the masters' education. Additionally, many NPs hold a Doctor of Nursing Practice (DNP) degree. The Nurse Practitioner Roundtable - a group representing the association of schools of nursing, the NP faculty association, the various NP specialty associations, and the AANP - has strategically positioned itself as transitioning the training, licensure and

certifications of future NPs to require a clinical-doctorate. That is, future NPs will graduate with a DNP designation, beginning with the class of 2015 (American Association of Nurse Practitioners, 2013).

This approach of requiring further specialization and differentiation with additional education is not unique to the nursing profession. Pharmacists and optometrists are required to earn a doctorate degree before practicing. Similarly, physical therapists must complete a specialized clinical-doctorate program. A comparison of the educational and clinical practice requirements between a NP and primary care physician can be found in Table 3.

Table 3
Differences in Education between Nurse Practitioners and Primary Care Physicians

Primary Care Physician	**Nurse Practitioner***	**Nurse Practitioner****
4 years undergraduate (*no specific major requirement*).	4 years undergraduate in *nursing.*	4 years undergraduate in *nursing.*
Immediate transition into medical school without a clinical experience.	5-7 years of specialized nursing practice in an area related to the masters education (e.g., *full time on a pediatric in-patient nursing unit).*	5-7 years of specialized nursing clinical practice in an area related to the doctoral education (e.g., *full time on a pediatric in-patient unit).*
4 years medical school.	2 years clinical Master's training.	3-5 years clinical doctorate training.
3 years residency.	A few residencies exist, but they are not mandatory.	A few residencies exist, but they are not mandatory.

*Current educational requirements.
**Requirements in effect as of 2015.

Different Types of Nurse Practitioners

The first NP program was developed at the University of Colorado in 1965. Since then, requirements for education, training, and licensure of NPs have evolved to include specializations in Family NP (FNP), Adult NP (ANP), both acute and primary care, Pediatric NP (PNP), both acute and primary care, Women's Health NP (WHNP), Psychiatric Mental Health NP (PMHNP), Gerontological NP (GNP) and Neonatal NP (NNP). Recently, the Adult and Gerontology NP (AGNP) certifications have merged into a new role. In addition, since 1965, a growth in other Advanced Practice Registered Nurses (APRN) has been evident, including; Certified Nurse Midwives (CNM), Clinical Nurse Specialists (CNS), and Certified Registered Nurse Anesthetists (CRNA). In addition, many NPs further continue their training and education by concentrating in sub-specialties, such as, neonatal, pediatric, psychiatric, cardiovascular, emergency care, neurology, oncology, palliative care, and more (American Association of Nurse Practitioners, 2014).

The National Council of State Boards of Nursing (NCSBN) adds further details and complexity in identifying the various types of APRNs including NPs. Specifically, NCSBN has developed a consensus model, an education and political campaign aimed at legislators and the public at-large, which groups the APRNs into four categories: (1) Certified Registered Nurse Anesthetist (CRNA), (2) Certified Nurse Midwife (CNM), (3) Certified Nurse Specialist (CNS), and (4) Certified Nurse Practitioner (CNP). In this particular model, ANPs and FNPs (which will be a part of this study) are included in the CNP category. Although there are a number of similarities in the titles as defined by AANP and NCSBN, there are sufficient differences to cause confusion among the public

and policy makers with regard to building national support for standardized educational, licensure, and certification requirements to allow NPs to practice more independently and efficiently

Types of Patients Served by Nurse Practitioners

According to AANP (2014), NPs care for many different types of patients and have been in practice for an average of 11 years. Nearly 88% have a primary care focus and nearly 67 % have an adult and family practice focus. A sample of this information is provided in Table 4.

Table 4
Patients Served by Nurse Practitioners and Average Years of Practice

Population Served	Percent of NPs	Years in Practice
Family *	48.9	12.8
Adult *	18.9	11.6
Pediatric *	8.3	12.4
Women's Health *	8.1	15.5
Acute Care	6.3	7.7
Mental Health/Psych	3.2	9.1
Gerontological *	3.0	11.6
Neonatal	2.1	12.2
Oncology	1.0	7.7

* Primary Care Focus.

In an attempt to define the target population for the opening of an NMC and to better market the services that were designed to be provided solely by NPs, 1,000 employees at a non-profit hospital selected several desired services for working with

families in a large metropolitan area (Brown, 2007). More than 80% of the participants selected women's health and urgent care as their highest priority. This is followed by services for immunizations and evening and weekend care at 70% and 64%, respectively. A sample of this information is provided in Table 5.

Table 5
Patients' Desired Services from Nurse Practitioners

Service	Percentage
Women's health care	84
Urgent care	81
Immunizations	70
Evening and weekend care	64
Wellness or weight loss	60
Chronic disease management	53
Mental health	38
Pediatric	27
Cosmetic (such as Botox injections)	13

Quality of Care and Patient Satisfaction by Nurse Practitioners vs. Physicians

The research on NP practice has been shown to be equal to or comparable to physician practice. In a seminal review of nursing care, Brown and Grimes systematically reviewed more than 900 articles over 30 years. Within these studies, based on randomize control trial (RCT) data, the authors discovered greater compliance by patients in medication adherence, behavioral changes, follow-up appointments, and higher patient satisfaction when treated by NPs. The results were equal to physicians when compared to overall quality of care, functional status, number of visits, and use of EDs (Brown & Grimes, 1995).

In another landmark, RCT study of 1,300 patients with similar productivity requirements and admitting privileges between NPs and physicians, researchers found no significant differences in outcomes for diabetes and asthma. Additionally, it was discovered that NPs managed blood pressure values with greater consistency and NPs hospitalized patients at a level similar to that of physicians (Mundinger et al., 2000). As a follow-up to the Mundinger study, 2 years later, investigators detected no differences in health measures; disease specific outcomes; and in the use of specialists, EDs, or in-patient services (Lenz, Mundinger, Kane, Hopkins, & Lin, 2004).

In a review of 11 RCT and 23 observational studies, Horrocks et al. (2002) determined that patients were more satisfied with care from a NP and that NPs spend more time with patients than physicians (Horrocks, Anderson, & Salisbury, 2002). Laurant et al.(2004), in a Cochrane meta-analysis, found no significant differences between physicians and NPs for patient outcomes or utilization, but discovered that NPs had longer visits with patients, NPs tended to provide more information than physicians, and that NPs provide quality care and produce outcomes similar to those of physicians (Laurant et al., 2004). Additional studies indicate better outcomes in preventative health services, greater patient independence, promotion of health, quality of life, fewer ED visits, and greater satisfaction with NPs as compared to physicians (Brooten, Youngblut, Kutcher, & Bobo, 2004).

In a study using Health Employer Data Information Systems (HEDIS) measures, Barkauskas and colleagues (2005) showed that six NMCs met and often exceeded the HEDIS benchmarks in treatment of chronic conditions (Barkauskas, Pohl, Benkert, & Wells, 2005). In the public health realm, in a five year study of patients residing in

homeless shelters, interventions by NPs achieved a 91% completion rates for latent tuberculosis management (Nyamathi et al., 2008).

Cost Effectiveness of Nurse Practitioners vs. Physicians

For over 20 years, research has found that NPs are often more cost effective than physicians. In a study by the Office of Technology Assessment (OTA), researchers demonstrated that health care provided by NPs was more cost effective than similar care provided by physicians (LeRoy & Solkowitz, 1981). In fact, this study became the impetus for state Medicaid agencies to change their state laws and reimburse NPs for their services. In another study comparing reimbursement systems for rural or urban settings, researchers demonstrated that Health Maintenance Organizations (HMO) lacked a significant relationship with NPs in both settings and that there was substantial room to shift utilization to NPs in hospital outpatient clinics (Anderson & McDaniel Jr, 2000).

The findings of a RCT study of NP clinics versus physician clinics demonstrated that results were similar for tests and prescriptions ordered and that differences in costs stemmed from the extended time that NPs spent with their patients and the extra work performed (Venning, Durie, Roland, Roberts, & Leese, 2000). In a study at the primary care practices of a Managed Care Organization (MCO), lower labor costs were demonstrated with practice sites that utilized NPs after standardizing for case mix (Roblin, Howard, Becker, Kathleen Adams, & Roberts, 2004). Results from a three year study by Chenoweth et al. (2008) showed a benefit-to-cost ratio of 8.7 to 1 and a savings ratio of 2 to 1 for 88.5% of all conditions treated by NPs (Chenoweth et al., 2008).

In assessing cost effective options for Massachusetts after the passage of statewide health insurance reform, Eibner and colleagues (2009) recommended that an increase in utilization of NPs could yield a projected savings of $4.2 billion to $8.4 billion over a 10 year period (Eibner, Hussey, Ridgely, & McGlynn, 2009). Considering the similarities between ACA and the Massachusetts health care law, it is reasonable to assume that other states could achieve comparable savings. In studying the cost effectiveness of NPs in retail clinics, Mehrotra and colleagues (2009) demonstrated significantly lower costs for three common illnesses compared to similar care at physician offices, urgent care centers, and EDs (Mehrotra et al., 2009).

Subsequently, numerous studies conducted in a variety of environments have resulted in similar conclusions on savings accrued from reduced ED visits, increased medication refills, compliance with medicinal regimen, reduced labor costs, and the average NP services costing 20% less than similar services by a physician (Blackmore et al., 2013; National Nursing Centers Consortium, 2010).

REIMBURSEMENT MECHANISMS FOR NURSE PRACTITIONERS

Nurse Practitioners are reimbursed using a complex formula that was originally developed to compensate physicians. This reimbursement system uses the (1) International Classification of Diseases (ICD) code, (2) Current Procedural Terminology (CPT) code, and (3) Relative Value Unit (RVU), among other methods, to determine payment for health care services provided.

International Classification of Diseases (ICD) Code

An ICD code is a three-to-five-digit numeric or alphanumeric code that is used to diagnose and classify both inpatient and outpatient health conditions and procedures. The ICD code is maintained by the World Health Organization (WHO) to track the occurrences of epidemiological events and is updated in collaboration with multiple entities and countries across the world (WHO, n.d.). Although, ICD codes are still used for epidemiological purposes, their use has been extended to include calculation of reimbursement for services by standardizing the coding of numerous diagnoses and procedures, determining medical liability, auditing and determining coverage and denials by third party payors, demonstrating medical necessity, compiling of data and statistics on patients and providers and assessing the quality of services provided and research (Centers for Medicare and Medicaid Services, 2014b, 2014c).

The first three digits of an ICD code are called the "category". The category defines the general illness of the patient. The fourth digit is called the "sub-category". The sub-category defines the site, cause or manifestation of the illness. The fifth digit is called the "sub-classification". The sub-classification provides additional detail related to the sub-category. A provider is expected to code to the 5th digit as often as possible. In the current version of the ICD manual, ICD 9th Revision, there are 17,849 codes. In the next update to the ICD manual, ICD 10th Revision, the number of total available codes is expected to increase to 141,747 codes (CMS, 2014).

It is reasonable to imagine that the nearly 8 fold increase in the total number of codes in ICD 10 alone, would cause additional complexity, but this is further complicated

because the ICD 10 codes increase to up to 7 digits – and providers will still be expected to code to the 7th digit (as opposed to the 5th digit in ICD 9) as often as possible.

Current Procedural Terminology (CPT) Code

A CPT code is a five digit numeric identifier which is owned and maintained by the American Medical Association (AMA) to describe services rendered while providing care to patients (Centers for Medicare and Medicaid Services, 2014a). These services may include evaluation and management of medical, surgical, radiology, laboratory, and other health care procedures. The purpose of a CPT code is to provide a uniform language that captures all of the services provided during a patient's visit as well as a uniform language for communication among providers, payors, researchers, and others (American Medical Association, 2014). There are approximately 7,800 CPT codes, and the five digit numeric codes are formatted as 00100 through 99499. Notably, CPT codes identify services rendered for the problem presented by the patient and not the diagnosis of the presenting problem.

Generally, CPT codes 99201 through 99205 are used to capture evaluation and management (E&M) services for new patients and have a typical time associated with the CPT code. For example, CPT code 99201 (New Patient - Level 1), the most basic code for E&M services for a new patient indicates that 3 key pieces of work were performed: a problem focused history, a problem focused examination and a straightforward medical decision making. CPT code 99201 (New Patient - Level 1) is estimated to take 10 minutes.

Generally, CPT codes 99211 through 99215 are used to capture E&M services for established patients and have a typical time associated with the CPT code. For example, CPT code 99215 (Established Patient - Level 5), the most complex code for E&M services for an established patient indicates that at least 2 of 3 key pieces of work were performed: a comprehensive history, a comprehensive examination and medical decision making of high complexity. CPT code 99215 (Established Patient - Level 5) is estimated to take 40 minutes.

A sample of the 10 most commonly used CPT codes in primary care visits, their descriptions, and the typical amount of time spent in the evaluation and management of the patient and/or family is provided in Tables 6 and 7. (Centers for Medicare and Medicaid Services, 2014b, 2014c).

Table 6
CPT Codes and Typical Time Spent for New Patients

CPT Code	Code Description	Typical Time
99201	Review 3 key components: a problem focused history; a problem focused examination; straightforward medical decision making. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are self-limited or minor.	10 minutes
99202	Review 3 key components: an expanded problem focused history; an expanded problem focused examination; straightforward medical decision making. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are of low to moderate severity.	20 minutes
99203	Review 3 key components: a detailed history; a detailed examination; medical decision making of low complexity. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are of moderate severity.	30 minutes
99204	Review 3 key components: a comprehensive history; a comprehensive examination; medical decision making of moderate complexity. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are of moderate to high severity.	45 minutes
99205	Review 3 key components: a comprehensive history; a comprehensive examination; medical decision making of high complexity. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are of moderate to high severity.	60 minutes

Table 7
CPT Codes and Typical Time Spent for Established Patients

CPT Code	Code Description	Typical Time
99211	Outpatient visit for the evaluation and management of an established patient, that may not require the presence of a physician or other qualified health care professional. Usually, the presenting problem(s) are minimal.	5 minutes
99212	Review 2 of these 3 key components: a problem focused history; a problem focused examination; straightforward medical decision making. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are self-limited or minor.	10 minutes
99213	Review 2 of these 3 key components: an expanded problem focused history; an expanded problem focused examination; medical decision making of low complexity. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are of low to moderate severity.	15 minutes
99214	Review 2 of these 3 key components: a detailed history; a detailed examination; medical decision making of moderate complexity. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are of moderate to high severity.	25 minutes
99215	Review 2 of these 3 key components: a comprehensive history; a comprehensive examination; medical decision making of high complexity. Counseling and/or coordination of care is provided as necessary. Usually, the presenting problem(s) are of moderate to high severity.	40 minutes

Relative Value Unit (RVU)

An RVU is a formula that uses a common scale to rank the resources required to provide a service at both hospital settings and non-hospital settings. For the purpose of this current investigation, only non-hospital RVUs will be discussed. The RVU scale is owned and updated by CMS in consultation with AMA and its Relative Value Scale Update Committee (RUC). For each service, an RVU uses a formula comprised of three components: (1) physician work, (2) practice expenses, and (3) malpractice insurance expense.

The above three line items, along with the adjustment for the triennially updated CMS Geographic Price Cost Index (GPCI) and the adjustment for the annually updated CMS Conversion Factor (CF), comprise the Total RVU and determine reimbursement in dollars (Centers for Medicare and Medicaid Services, 2014d; Dummit, 2009).

A more detailed explanation of the RVU calculation is as follows:

1. Physician Work RVU (RVU_{PW}) accounts "for the time, technical skill and effort, mental effort and judgment, and stress to provide a service". RVU_{PW} accounts for 54.5% of the Total RVU. Moreover, RVU_{PW} is comprised of the following two components:
    a. Time. This accounts for approximately 70% of RVU_{PW} and
    b. Effort. This accounts for approximately 30% of RVU_{PW}
2. Practice Expense RVU (RVU_{PE}) accounts "for the non-physician clinical and non-clinical labor of the practice as well as expenses for building space, equipment, and office supplies". RVU_{PE} accounts for 42.3% of the Total RVU.
3. Malpractice Expense RVU (RVU_{MP}) accounts "for the cost of malpractice insurance premiums". RVU_{MP} accounts for 3.2% of the Total RVU.

* The Geographic Price Cost Index (GPCI) is calculated in a manner similar to RVUs and includes three components as well: $GPCI_{PW}$, $GPCI_{PE}$, and $GPCI_{MP}$. Each of these three GPCIs adjusts its corresponding RVU component. In other words, GPCI adjusts the Total RVU payment to reflect regional differences in costs for providing care. For example, a $GPCI_{PE}$ of 1.2 would indicate that the practice expenses in that area are 20% above the national

average, whereas a $GPCI_{PE}$ of 0.8 would indicate that the practice expenses in that area are 20% below the national average (MaCurdy et al., 2012).

* The Conversion Factor (CF) is a dollar amount that CMS adjusts annually to reflect inflation, budgetary and political realities, and other considerations.

Thus, the formula to calculate an RVU is as follows:

$$[(RVU_{PW} * GPCI_{PW}) + (RVU_{PE} * GPCI_{PE}) + (RVU_{MP} * GPCI_{MP})] * CF_{CY2013}$$

As an example, the RVU and the reimbursement, in dollars, for a typical mid-level office visit in Los Angeles, CA, for an established patient with a CPT code of 99213, would be calculated as follows:

$$RVU = [(RVU_{PW} = 0.97) + (RVU_{PE} = 1.03) + (RVU_{MP} = 0.07)] = 2.24$$

$$\text{Reimbursement} = [2.24 * (CF_{CY2013} = \$34.04)] = \$76.18$$

NOTE: The Total RVU of 2.24 includes adjustments for GPCI. A more detailed explanation of the above calculation can be found in Table 8 (Medicare Payment Advisory Commission, 2013).

Table 8
Geographical Adjustment of RVUs with GPCIs

Input	Unadjusted RVU		GPCI		Total RVU
RVU_{PW}	0.97	*	1.04	=	1.01
RVU_{PE}	1.03	*	1.15	=	1.18
RVU_{MP}	0.07	*	0.64	=	0.04
Total	2.07			+	2.24
CF				*	$ 34.04
Reimbursement				=	$ 76.18

Any differences in calculations are based on rounding.

That is, for services rendered that resulted in a CPT code of 99213, a mid-level office visit in Los Angeles, CA, taking an average of 15 minutes (see Table 8); the physician (or NP working for a physician and billing for their services as an indirect visit) would receive $76.18 in reimbursement. However, an NP, providing similar services but billing the visit as a direct service (i.e., billed under the NPs name), would receive $64.75 in reimbursement. This is a net reduction of 15%. It is important to note, however, that the RVU calculations are based on physician data alone; differing malpractice rates and NMC practice expenses are not incorporated in the CMS calculations or reevaluations.

Since the passage of the Balanced Budget Act of 1997 (BBA), NPs have been able to receive direct Medicare reimbursement, but at only 85% of the physician fee schedule. Further, this reimbursement rate has not changed since its inception 17 years ago. NPs continue to bill for services using CPT codes that physicians use and receive reimbursement using an RVU model that was developed specifically for the patterns and cost structure of a physician practice. Since NPs can receive direct reimbursement for services, data about work resources of NPs are needed for national payment policy (Sullivan-Marx & Maislin, 2000).

Current challenges include establishing differences between the work of NPs and physicians and changing the methodology for calculating RVUs. Prior to the enactment of the BBA, the work of an NP was hidden within physician services in databases that report Medicare reimbursement. These databases compiled the total amount of work performed by both NPs and physicians to produce reimbursement reports. The invisibility of an NP's work in determining reimbursement from Medicare and other payors further supports the need for valuation of the work done by NPs (Sullivan-Marx &

Maislin, 2000). Comprehensive primary care NMCs are ideal locations for determining these differences because NP reimbursements are direct reimbursements for all services.

In a study of NMCs in Michigan, researchers discovered that service revenue was the primary driver of financial viability, more so than controlling for costs alone (Vonderheid, Pohl, Barkauskas, Gift, & Hughes-Cromwick, 2003). Additional services often include health education and attendance to social factors. If a CPT code does not capture this additional work, then the existing RVUs cannot capture the entire scope of the visit by an NP, which leads to incorrect resource allocation and reduced service revenues (Vonderheid et al., 2004). A majority of NPs in another study mentioned that CPT codes were descriptive of the work they performed but lacked the ability to capture additional services performed by NPs (Sullivan-Marx, Happ, Bradley, & Maislin, 2000).

Summary of Literature Review

In summary, the literature offers numerous findings regarding the benefits of using NPs to provide health care services and these benefits can be measured in terms of reductions in costs, increases in quality, and enhanced utilization. Despite the evidence, NMCs and NPs have limited options in defining services and then procuring direct reimbursement for these services. Multiple researchers have identified these issues as sources of financial struggles for NMCs and NPs as well as barriers to becoming financially viable (McBryde-Foster, 2005; Ryan & Cowell, 2008; Vonderheid et al., 2003).

However, there is a paucity of research literature regarding the work component of the RVU (RVU_{PW}) specific to the practice patterns of an NP in an NMC. And, it has

been previously noted that such work patterns have proven valuable to society and have been cultivated over years of education and training, while conforming to the holistic nature of nursing.

THEORETICAL FRAMEWORK

The two theoretical frameworks that will be used to frame this research study are: 1) Complexity Theory (CT) and 2) Resource Based View (RBV).

Complexity Theory (CT)

The study of Complexity Theory (CT) is not the study of a single theory, but rather a collection of complementary and overlapping theories rooted in mathematics, physics, biology, and a variety of other sciences. Complexity theory has come to redefine and reframe many of society's existing views about systems. Previous models used traditional scientific insights, Newtonian mechanics, and machine metaphors to describe systems, but frequently offered only partial insights into these constructs (Chaffee & McNeill, 2007; Zimmerman, Lindberg, & Plsek, 2000). A number of authors have further noted that what frequently appears to be a linear and static organization is actually a more complex, adaptive, and non-linear organization (Holden, 2005; Paley, 2007; Plsek & Greenhalgh, 2001; Tan, Wen, & Awad, 2005). The idea of CT has been used to illustrate a Complex Adaptive System (CAS) that emphasizes the patterns of relationships within the system, how these patterns are sustained, and how outcomes emerge (Chaffee & McNeill, 2007). Furthermore, CAS attempts to explain the

multifaceted, predictable, and unpredictable behavior that transpires in dynamic and non-linear systems.

Complex Adaptive System (CAS)

A CAS is a cross-disciplinary approach that takes into account the larger system or ecosystem in which organizations operate. This ecosystem is theorized to be affected by the overt and the covert relationships and the interactions taken by individuals and systems, including spontaneity and self-organization among human resources, culture, laws, regulations, economic competitors, demographic changes, and more. McMurty (2007) described CAS as follows:

> "When you kick a stone, it will react to the kick according to a linear chain of cause and effect. Its behavior can be calculated by applying the basic laws of Newtonian mechanics. When you kick a dog, the situation is quite different. The dog will respond with structural changes according to its own nature and (nonlinear) pattern of organization. The resulting behavior is generally unpredictable." (McMurty, 2007)

Characteristics of a CAS. A CAS is typically comprised of five characteristics, which are listed below along with their application to health care (McDaniel & Driebe, 2001).

1. *Agents.* A CAS is composed of unique individuals (agents) who are processors of information. Health care organizations are systems that have agents with valuable, rare, imperfectly imitable, and imperfectly substitutable skills who process information through their own lens (Yarbrough & Powers,

2006). A lens that has been developed through years of diverse socialization and relationships acquired from their unique background, education, culture, experience, and more. Further, the more novel the relationship of the agents, the more novel the exchange and interaction of the information and the more novel and unexpected the outcome (Anderson, Crabtree, Steele, & McDaniel, 2005). This diversity is critical for a CAS to function as a source of change, originality, adaptability and the creation of inimitable and non-substitutable behaviors and relationships.

2. *Interconnections.* While the diversity of agents is necessary for a CAS to function, its complexity and distinctiveness is derived from the patterns of rich relationships and interactions that these agents create. Moreover, these relationships are non-linear and may affect other characteristics of a CAS. Interactions have been found to be local, but the patterns global. Thus, NMCs function similarly, but may differ in their operations when working under a campus health center model or a FQHC model. To put another way, "small causes might have large effects and large effects might have small causes" (Anderson et al., 2005). Relationships are an integral part of a health care system. Individuals have a limited understanding of the complexities involved in the relationships or the interconnections between specialized professionals who have been taught, via education and culture, to treat patients from their own narrow, and independent perspective defined by their professions (D'Amour, Ferrada-Videla, San Martin Rodriguez, & Beaulieu, 2005).

3. *Self-organizing.* Diverse agents and their interconnections lead a CAS to be self-organizing. New paradigms and constructs are created and destroyed with frequency. Nurse Practitioners may be limited in their practice rights by the varying and complex SOP laws, but, as one physician stated, "I have worked with and supervised many NPs and for those that are just starting out, chart review is quite useful. For someone 20 years out? Not so much" (Yee et al., 2013). In this example, it can be seen that the local reality is being altered and self-organized by the patterns of smaller interconnections that are independent of what the larger system intended via implementing highly restrictive SOP laws for centralized control and command.
4. *Emergence.* In a CAS, the properties of the whole are distinct from the properties of the individual parts. The 3 previously identified characteristics of a CAS interact in fresh new ways to cause a different system to emerge, one with new and previously unknown properties. For example, is it prudent for a health care human resources (HR) department to focus on an individual employee or an emergent team of workers? Would a quality improvement initiative be better served when the focus is on an emerging and improved process, rather than the individuals in the organization?
5. *Coevolution.* In a CAS, a group of agents with interconnected, self-organizing, and emergent characteristics create new sub-systems. These sub-systems, in turn, affect different sub-systems of the larger system and force these sub-systems to coevolve and, eventually, compel the larger system to coevolve as well. Additionally, because of the co-evolving nature of a

> system, a system's current and future state are closely linked to its history and its current relationships with other systems. If NPs are able to change the process for calculating RVUs, other health care related changes will soon follow. These changes could, potentially, include: new types and categories of NPs; new practice settings and models; changes in the policy statements of professional physician associations to support parity between NPs and physicians; payors that offer full reimbursement for NP services; other health care providers that begin to strive for their own independent and less restrictive practice rights; retail clinics, politicians, legislation and patients who want and are provided with choices for their health care needs, etc. Intrinsically, these sub-systems will coevolve and create a new system.

A CAS gives us an insight into conceptualizing NMCs and the work of NPs within those NMCs. A NMC is defined as a primary care practice and primary care practices, along with other health care systems, have been described as having the characteristics of a CAS by several researchers (Anderson, Issel, & McDaniel Jr, 2003; Crabtree, 2003; Litaker, Tomolo, Liberatore, Stange, & Aron, 2006; McDaniel Jr, Lanham, & Anderson, 2009; McDaniel & Driebe, 2001). Specifically, CAS demonstrates that there are a significant number of interconnections that occur within a system, NMCs and NPs in the case of this study, and the key to understanding the whole lies in understanding the patterns of behaviors and relationships among the agents of that system (Anderson et al., 2005).

The rich concepts of CAS provide an insight into understanding a problem in a context-rich environment. As previously stated, a basic tenet of a CAS is that it is a non-linear and emergent system. Linear systems are generally predictable. Yet, non-linear systems are not random; they simply propose a different form of order (Arndt & Bigelow, 2000). Marion and Bacon (1999) stated that, a CAS is "on the border between predictability and non-predictability".

It should be noted that CAS does not imply intractability. Begun (2012), in an interview stated that the "path to simplicity and control often passes through complexity" (James W. Begun PhD, March-April, 2012). This concept was noted "decades before the emergence of complexity science as a unified field 'one cannot study the complexity of a system without specifying the content of complexity'" (Kannampallil, Schauer, Cohen, & Patel, 2011). Therefore, the challenge lies in defining the granularity of the problem being studied and thus, providing the content, context and simplicity.

It is here that we encounter the RBV theory. The current review of CAS has provided a lens for viewing the NMC as a complex system and the agents within the system, as a whole. However, from this broad perspective, the study requires a more focused view into the system to understand the interactions of the agents. That is, the interaction between the NP and the patient, that was previously unclear and has now been highlighted by CAS, can now be better understood by the principles of RBV.

In this setting, the theory of a CAS provides a model for the strategic application and management of RBV, particularly for industries in which the central charge is managing change while being constrained with limited resources and increasing demand.

Resource Based View (RBV)

The RBV theory states that organizations can create unique competitive advantages that are a non-duplicable and non-substitutable combination of knowledge, productivity, culture, skills, and rarity (Dussault & Dubois, 2003). The RBV of a system provides a perspective that illuminates how resource-availability, both internally and externally, influences decisions for strategic structure, heterogeneity, and partnerships within the health care industry (Yarbrough & Powers, 2006). Resources can be any asset that belongs to the system in the form of capital, finance, knowledge base, buildings, equipment, tools, human resources, etc. RBV theorizes that some of those assets may offer more competitive advantage than other assets to the system. This current research will focus on the productive efficiency gained from human assets, i.e. NPs, within a system.

Researchers have suggested that collaborative and interconnected health care teams will be required to effectively coordinate the increasingly complex health care systems. For example, the ever-increasing knowledge in the complex training and technological standards, experimental and confirmed changes in reimbursement systems and care delivery methods, increased focus on population health management, demand for evidence-based practice, increasing and complex social needs of patients, and many more factors (Carroll & Rudolph, 2006; Katzenbach & Smith, 1992; Khatri, 2006; Lemieux-Charles & McGuire, 2006). That is to say, all resources, human and non-human, among all disciplines, working in concert with one another and in the right context, is a potential solution to achieving the elusive balance between quality and value in health care.

Additionally, in the face of shortages and turnover of health care professionals of all types, clinicians and non-clinicians and in all practice locations, it becomes increasingly imperative that health care leaders, practitioners and stakeholders, learn how to best work with limited and ever-shrinking resources. In one study, researchers discovered that the minimum cost of turnover at an academic medical center exceeded 5% of the total operating budget (Waldman, Kelly, Aurora, & Smith, 2004). Finally, the shortage and turnover of health care professionals is only compounded by the increasing demands of the baby boom generation and soon, by the rising needs of new enrollees under the ACA.

The current methods of administering human resources in health care to manage labor shortages and turnover by allocating extra resources to training additional personnel, is not likely to solve the human resources problem or provide strategic, long-term, and sustainable solutions to current health care challenges. As stated by Hall (1998, page 6):

> "A decision to change medical student intakes by 10% will only change the doctor supply by about 2% in the first 10 years! Thus, doubling of medical student intakes would increase the doctor supply by only 20% in 10 years, but during the subsequent decade the effect could be far greater. Even with shorter training timelines for health worker careers such as nursing, it takes a long time to implement major quantitative or qualitative changes, and an equally long time to undo major mistakes." (T. L. Hall, 1998).

In summary, if RBV helps us to look at the resources available to an organization within its own boundaries, then, CAS helps when looking at the resources available to an

organization within the entire ecosystem. If RBV is meant to be organized and managed, CAS is self-organizing and adaptive. Therefore, CAS provides a fundamental insight in using RBV in the health care setting. Specifically, that there are frequent and abundant interconnections between the resources of a health care organization that cannot be easily managed or even fully predicted, but their existence must be acknowledged, and in doing so, we can find the next steps to be taken.

Application of CAS and RBV Theories to Nursing

The use of CAS as a framework to understand a wide range of phenomena is increasing, including in nursing and health care management. Begun and White (1999) have described nursing as a complex adaptive system with identified characteristics and suggested strategies for change within the profession (J. Begun & White, 1999).

The CAS theory was applied to test the relationship between management practices and resident outcomes of nursing homes (Anderson et al., 2003); CAS theory was also beneficial in understanding how professional and organizational changes in the public health nurse program in the United Kingdom's National Health Service were more successful than others when providing services in urban environments (Rowe & Hogarth, 2005); CAS theory was used to successfully sustain and achieve the prevention of surgical site infections by clinical nurse specialists (Sitterding, 2005) and has been used as a model for nurse managers to thrive with mergers and acquisitions when traditional methods were not sufficient (Walls & McDaniel Jr, 1999).

In the IOM's report, *Crossing the Quality Chasm: A New Health System for the 21st Century*, Plsek (2001) identified CAS as a potential model for redesigning a safer

health care system. Additionally, in reviewing the recommendations on medication errors, Plsek and Dooley (2001) suggested that IOM's recommendations were not sufficient and did not extend far enough to promote system-wide interconnectedness and emergence of new systems (J. W. Begun, Zimmerman, & Dooley, 2003). In a study of three elder care organizations, Marion and Bacon (1999) discovered that the one organization that had built successful interactions, collaboration, and dependence with multiple and diverse organizations – hallmarks of a CAS − thrived as compared to the other two elder care organizations. A direct review of 84 primary care practices and 27 practices from similar studies revealed that CAS came the closest to explaining the success of these organizations (Crabtree, Miller, McDaniel, & Stange, 1998). In a study to improve health care for city dwellers, researchers found that a city's characteristics of self-organization, dynamic interactions, local conditions, and non-predictability fit well with a CAS model (Glouberman et al., 2006).

The theory of CAS merges well with the tradition in nursing in which NPs view patients and nursing care from a systems and holistic perspective (Holden, 2005). This holistic perspective is an acknowledgment of the complex world that the patient resides in, affects and is in turn, affected by, the world. The ANA estimates that 2.9 million nurses practice their profession in diverse organizations and provide care at varying points in the health care industry (American Nurses Association, 2014). These practice sites and practice points range: from small to large NMCs, across highly restrictive to fully open scope-of-practice state regulations, from rural to urban, from for-profit and non-profit health systems to the military, academia, and research institutions. When the profession of nursing is viewed through the lens of a CAS, it is possible to visualize key

components and relationships within the system and then develop new approaches to nursing practice (Chaffee & McNeill, 2007).

In order to view the challenges of studying the work performed by NPs as a small part of a larger and more complex system, it is essential to understand how the productive efficiency of NPs both affects, and is subsequently affected by, the remaining parts of the system. In a CAS, it would not be possible to study the differences in the development of work/time RVUs without also being aware of the effects that scope-of-practice laws, quality outcomes, practice locations, educational qualifications, professional differences in work, autonomy and territory, and more, can have on the development of an RVU.

It has been suggested that adopting the ideas of complexity science in nursing may be vital for the profession's survival, as nursing is often seen as intransigent and held in place by inertial forces (J. Begun & White, 1999). The model of a CAS offers the profession of nursing a powerful opportunity to reframe its research agenda, train its leaders and practitioners, influence policy decisions, and design clinical practices in new and innovative ways (Chaffee & McNeill, 2007). Understanding NMCs as a CAS and the NPs within them via RBV, potentially equips NPs to enhance their capacity to adapt to and manage an unknowable future and to inform the design of complex change processes in health care (Stroebel et al., 2005).

Summary of Theoretical Framework

Framed by Complexity Theory (CT), the construct of a NMC should be viewed as a CAS instead of a linear and machine-like bureaucracy. These NMCs have diverse agents (i.e., NPs) as well as relationships and interconnections with other schools of

nursing, professional associations, fellow practice locations, etc., that are essential to their survival and the success of their patients. Further, NMCs self-organize, emerge, and coevolve in consent with their agents and settings (McDaniel & Driebe, 2001).

Focused by RBV, within a CAS, the work of an NP should be guided by and further refined by the principles of resource utilization. A NP that is properly deployed based on non-substitutable and non-duplicable resources would provide a competitive advantage to the nursing profession and to the NMC as a whole. This new competitive advantage, gained from the RBV perspective and understood by CAS, would then lead the firm (NMC) and its agents (NP) to modify the existing status quo.

Based on the literature review and directed by the conceptual framework of CAS and RBV, it is anticipated that NMCs will exhibit the characteristics of a CAS and the NPs working within the NMC, will have their most efficient options for resource allocation clarified by the RBV theory. Consequently, the following research question will be asked and the following hypotheses will be developed and tested.

Research Question

Which factors within the daily practice of NPs contribute to the productive efficiency in Nurse Managed Centers?

Hypotheses

There is a great deal of interest within the health care industry in determining the right combination of technical efficiency and labor allocation to resolve the many challenges in health care (Bauer, 2010; Cooper, 2007; Naylor & Kurtzman, 2010;

Wennberg, 2002). Nurse Practitioners are a crucial source of readily available and cost effective providers with technical proficiency in providing increased access to health care services.

This is evident in the reduced time to educate, reduced cost, high training standards, patient centered practice patterns and high quality outcomes of NPs. However, due to the attention being placed on reducing the cost of health care, one could assume that NPs would be a highly competitive option in any efforts towards reducing health care costs. Although, and at the same time, it could be assumed that the most efficient method to deploy the input (NP) to affect the output (health care services) is to simply produce more NPs for reasons mentioned previously. However, limited data exists to determine if NPs provide the level of productivity efficiency that would reduce health care costs. A decision to deploy this scarce resource requires further study. Without such data, the system would be losing an opportunity to make a lasting impact on health care.

Productive efficiency is defined by many inputs and many outputs. That is, the measurement for productive efficiency is not limited to one input and one output. CAS takes into consideration the multitude of inputs and outputs involved in a system and RBV theorizes that some of those inputs and outputs may offer more competitive advantage than other inputs and outputs to the system. The purpose of this study was to examine the many inputs and outputs from a CAS model and a RBV model and to explore if the selected variables are having the hypothesized effect.

Based on the need to deploy a scarce resource in a complex environment with the most efficient use of input for the maximum output, the following hypotheses will be tested.

Hypothesis 1

The presence of additional ICD codes could indicate the presence of comorbid conditions requiring prolonged, ongoing and complex care management and thus, the additional use of time. Patients with comorbidities have been shown to have frequent hospitalizations, higher rates of prescription medications, use of multiple providers and higher referral rates to specialists and increased costs (Bodenheimer & Berry-Millett, 2009). As noted previously, Medicare experienced a 24% increase in spending on patients with 5 or more chronic conditions. If the presence of multiple diagnoses could be noticed or addressed in the younger population, it might be possible to affect not only the rising costs of health care, but also to direct the resources, i.e. NPs, to the patients in greatest need. It is expected that providing care to patients with additional diagnoses beyond their primary diagnosis will lead to greater time to assign CPT code; thus hypothesis 1 states:

Hypothesis 1. In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* based on the number of additional secondary ICD codes assigned, while controlling for Patient Residency Status, Patient Age, Patient Gender and Years of Experience for the NP.

Hypothesis 2 and 3

Health literacy was first used as a term to define a broad social policy for incorporating health education in the education system (Parker, Ratzan, & Lurie, 2003). With the advances in medical knowledge and the ability to disseminate this information through a variety of digital and non-digital means, health literacy has grown to mean the

ability to obtain and process health education, health promotion and disease prevention knowledge affecting personal and public health (Nutbeam, 2000; Office of Disease Prevention and Health Promotion, 2015).

Furthermore, Healthy People 2010 advocated for health literacy as being increasingly vital for navigating a complex health system and for enabling people to better manage their own health (Healthy People 2010, n.d.). The focus on promoting health literacy continued as part of their objectives for Healthy People 2020 (Healthy People 2020, n.d.). Additionally, the IOM identified health literacy as an opportunity at the cross roads of quality care and other priorities (Institute of Medicine, 2004).

A lack of health literacy has been shown to lead to low health outcomes, lower knowledge of medical treatment and medical conditions and a higher rate of using health care services than the rest of the population (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Schillinger et al., 2002). Inadequate health literacy has been associated with increased costs, particularly when combined with comorbid and chronic conditions. In 2000, the direct costs for chronic conditions exceeded $500 billion dollars. This cost is projected to grow to more than $1 trillion by 2020 (Parker et al., 2003).

Moreover, language differences and cultural barriers contribute to reduced health literacy, as well. A study organized by the Commonwealth Fund 2001 Health Care Quality Survey, discovered that only 57% of their participants found it “very easy” to understand health information given by their providers. Low health literacy and language barriers among a diverse student population can translate to poor conceptualization of health risk when placed in the context of the modern U.S. health care system where greater demands are placed on health care consumers for self-management (Schillinger et

al., 2002). It is expected that working with patients who potentially have lower health literacy, as part of the nursing model, will require more time to assign CPT code; thus hypothesis 2 states:

Hypothesis 2. In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for International Patient Status, while controlling for the number of additional secondary ICD codes assigned, Patient Age, Patient Gender and Years of Experience for the NP.

Lastly, studies have also strongly suggested that health literacy has an inverse relationship with increasing age (Parker et al., 2003). Considering the age group of the participants in this study along with the holistic nursing model practiced by NPs mentioned previously, where capturing the teaching moment is central and reinforced through the lifespan, it is expected that the age of the patient will have an impact on time to assign CPT code; thus hypothesis 3 states:

Hypothesis 3. In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for increasing Patient Age, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Gender and Years of Experience for the NP.

Hypothesis 4

A number of studies have shown compelling evidence for the positive impact of gender concordance (female providers and female patients) during primary care visits. Gender preferences has been shown to affect communication (J. Hall & Roter, 1994), patient satisfaction (Bertakis, Franks, & Azari, 2002), practice style of the provider

(Kaplan, Gandek, Greenfield, Rogers, & Ware, 1995) and patient involvement (Street Jr, Gordon, Ward, Krupat, & Kravitz, 2005). Studies have shown that female patients show a preference for gender concordance more so than male patients (Garcıa, Paterniti, Romano, & Kravitz, 2003). Lastly, concordance is not limited to gender alone. A preference for concordance has been shown in language and culture, affecting the rating of the provider and provision of health care services. Such concordance extends to higher rates of preventative services such as, Pap tests, mammography and cholesterol screening (Garcıa et al., 2003). It is expected that providing care to a diverse population will lead to differences by gender; thus hypothesis 3 states:

Hypothesis 4. In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *different* based on Patient Gender, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Years of Experience for the NP.

Hypothesis 5

Clinical reasoning is a core component of nursing professional practice. As noted previously, in calculating reimbursement using RVU's, time accounts for 70% of the 54.5% allotted to the cognitive component in making a diagnosis. Benner's (1984) seminal work provided a framework to understand the relationship between nursing skills and years of experience. In defining the characteristics of clinical reasoning and decision making, Benner (1984), provided 5 categories of skills ranging from novice, advanced beginner, competent, proficient and expert nurse (Simmons, Lanuza, Fonteyn, Hicks, & Holm, 2003). Furthermore, the nursing process is described as a problem-solving process

requiring deductive reasoning skills during the provision of care, which is not necessarily the same from a novice NP to an expert NP (Taylor, 2000). It is expected that an NP with more years of experience will be more efficient at the deductive reasoning process; thus hypothesis 5 states:

Hypothesis 5. In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *lower* for increasing Years of Experience of the NP while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Patient Gender.

CHAPTER 3

RESEARCH METHODOLOGY

Purpose of the Study

The purpose of this study was to determine the productive efficiency of Nurse Practitioners (NP) in a Nurse Managed Center (NMC) in a highly restrictive scope of practice (SOP) state. This study will evaluate the differences in productive efficiency required to achieve selected International Classification of Disease codes (ICD) and selected Current Procedural Terminology codes (CPT) by NPs within a NMC.

The NPs are limited by the SOP laws of the state in which they practice. Furthermore, additional limitations may be imposed on their SOP by the site in which they practice. For this study, a NMC in Michigan was selected. Michigan is a highly restrictive SOP state, where physician involvement is needed to prescribe, but not to diagnose or treat. This NMC does not place any further restrictions on the NP's SOP, beyond those required by the State of Michigan. A summary of the SOP rights across the United States can be found in Figure 1.

Research Question

Which factors within the daily practice of NPs contribute to the productive efficiency in Nurse Managed Centers?

Hypotheses

Hypothesis 1: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* based on the number of additional secondary ICD codes assigned, while controlling for Patient Residency Status, Patient Age, Patient Gender and Years of Experience for the NP.

Hypothesis 2: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for International Patient Status, while controlling for the number of additional secondary ICD codes assigned, Patient Age, Patient Gender and Years of Experience for the NP.

Hypothesis 3: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for increasing Patient Age, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Gender and Years of Experience for the NP.

Hypothesis 4: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *different* based on Patient Gender, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Years of Experience for the NP.

Hypothesis 5: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *lower* for increasing Years of Experience of the NP while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Patient Gender.

Design

This retrospective study will examine quantitative data using a cross-sectional design to investigate the above research question. Data from an 11-month span, January 2014 thru November 2014, will be considered for analysis. The unit of analysis will be the individual patient visits defined as an interaction between the NP and the patient. The primary outcome of interest is the time required to achieve the selected CPT codes. The time to achieve selected CPT codes will be investigated separately for each ICD code under consideration.

Setting

This NMC provides a full range of primary care services via NPs and uses the full range of possible ICD and CPT codes that have been assigned to primary care services and evaluation and management services. The patient population for this NMC is a diverse audience of domestic and international students of varying ages and is situated in an urban environment in the State of Michigan.

Data Collection

One NMC in Michigan and the data from the NP-patient visit, contained within the Electronic Health Record (EHR) of that NMC, was selected for data collection. This NMC uses an EHR to provide and document health care services and collect data on the practice patterns of NPs and other staff.

The EHR automatically and consistently collects data on the time used by each staff member or provider who comes in contact with the patient's health record during the

patient's visit. As the patient checks-in at the front desk, the EHR starts the clock and then stops the clock when the patient is handed-off to the Medical Assistant. At this point, the EHR begins the clock again and continues to monitor the time until the patient is transferred from the Medical Assistant to an NP at which point the clock stops. The clock begins again when the patient is with the NP and stops when the NP is finished examining the patient. The time for each hand-off is logged and calculated as a separate event for each member of the care team.

In addition to recording standard demographic and insurance information, the EHR also records the ICD code(s) and CPT code(s) generated by the NP's treatment plan following the patient's visit with the NP. Furthermore, this treatment plan can include data such as counseling and education provided, prescriptions written and physician consultations, if any. Any visit that required a physician consult was excluded from this analysis.

The sample was narrowed from the original 851 cases to 827 cases to be included in the analysis. Of the total 851 cases, 23 cases were eliminated, as these cases had a "modifier 25" amended to the office visit. The addition of the "modifier 25", implies that on the day of the office visit an additional and separate Evaluation and Management code (E&M) was generated that was different from the primary E&M code. CMS states that "physicians and qualified non-physician practitioners (NPP) should use CPT modifier-25 to designate a significant, separately identifiable E&M service provided by the same physician/qualified NPP to the same patient on the same day as another procedure or other service with a global fee period" (Centers for Medicare and Medicaid Services, 2012).

Additionally, the American Academy of Family Physicians (AAFP) states that "separate, significant physician evaluation and management (E/M) is work that goes above and beyond the physician work normally associated with a preventive medicine service or a minor surgical procedure" (American Academy of Family Physicians, 2004). This suggests that additional time was spent with the patient, which was not expected and not the norm and therefore, could result in outliers in this analysis. Moreover, the dataset did not identify which additional diagnoses or services, if any, resulted in the additional E&M code. Lastly, one additional data point containing CPT code 99215 (Established Patient - Level 5) was eliminated as there was only one case of that instance in the entire sample. Figure 3 provides an illustration of the inclusion and exclusion criteria.

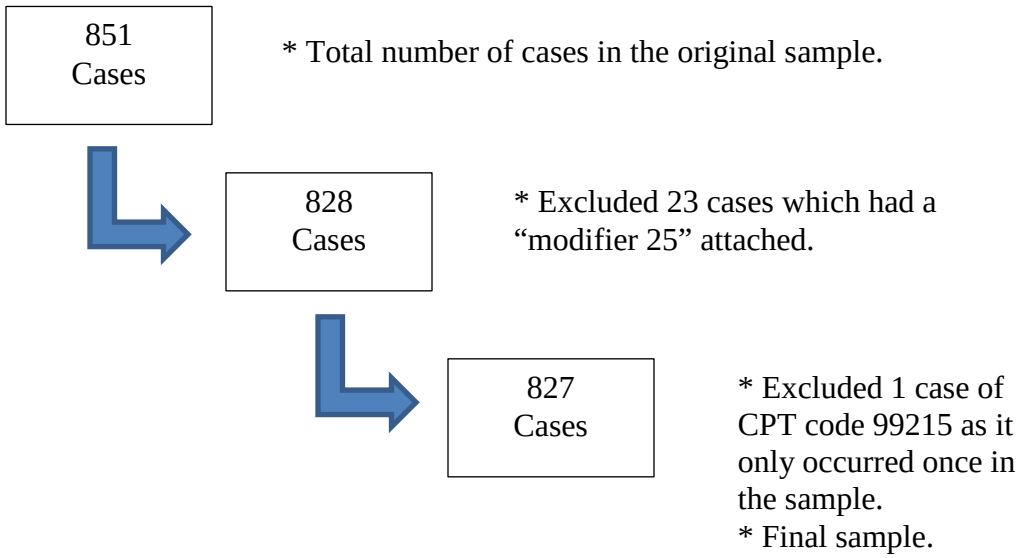


Figure 3. Criteria for Inclusion in Analysis Illustrated.

Measures

Dependent Variables

The dependent variable of primary interest is the:

1. Time for the NP to assign the specific CPT code with the specific ICD code.

   This variable is a listing of the time it takes for an NP to assign a CPT code, noted in minutes. This was measured as a continuous variable.

Independent Variables

The independent variables of primary interest are:

1. Number of Additional Secondary ICD codes (any number of additional ICDs assigned to a patient visit).

   This is a listing of total number of additional secondary ICD codes as collected by the EHR. Any record in the sample with any number of additional ICD codes is summed for each record. This was measured as a continuous variable.

2. Patient Residency Status (domestic or international student).

   This is a listing of the patient as a domestic or international student as collected by the EHR. This is controlled for via dummy variables, where domestic student = 0 and international student = 1.

3. Patient Age.

   This is a listing of the patient's age as collected by the EHR. This was measured as a continuous variable.

4. Patient Gender.

   This is listing of the patient's gender as collected by the EHR. This is controlled via dummy variables where male = 0 and female = 1.

5. Years of Experience for the NP.

   This is a listing of the years of experience for the NP. This was measured as a continuous variable.

Figure 4 provides an illustration of the research design mentioned above. Table 9 provides a listing of the operational variables along with their definitions and scale.

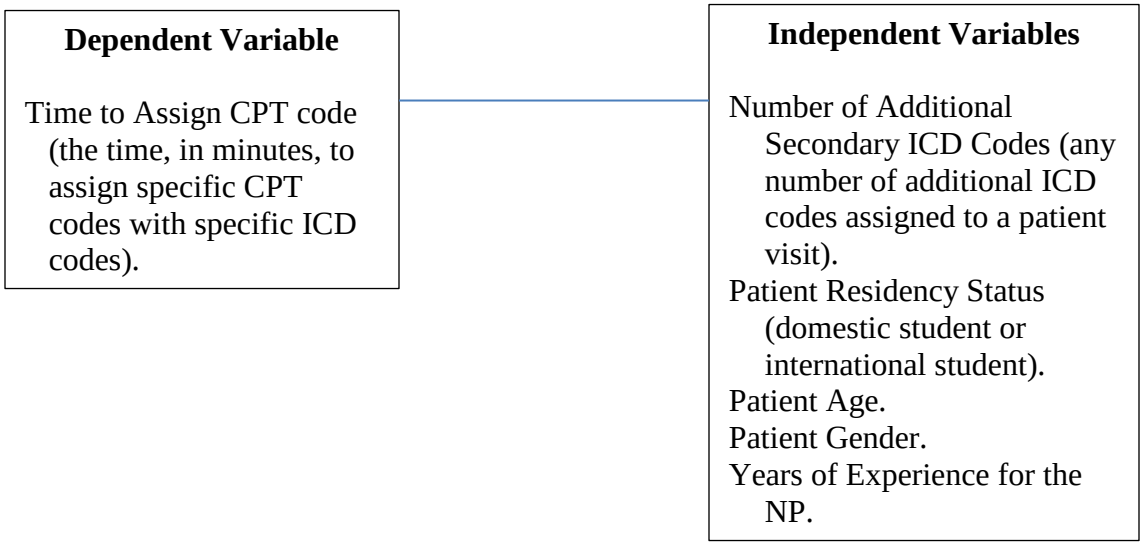


Figure 4. Research Design Illustrated.

Table 9
List of Operational Variables for Examination of each ICD and CPT Code

Variable	Description	Scale
Dependent		
Time for the NP to Assign CPT code	A listing of time, in minutes, for the NP to assign the specific CPT code to the specific ICD Code.	Continuous
Independent		
Number of Additional Secondary ICD Codes	A listing of the number of the secondary ICD codes within the primary ICD codes selected.	Continuous
Patient Residency Status	A listing of the patient as Domestic Student or International Student. Controlled for via a series of dummy variables.	Domestic = 0; International = 1
Patient Age	A listing of the patient's age in years.	Continuous
Patient Gender	A listing of the patient's gender. Controlled for via a series of dummy variables.	Male = 0; Female = 1
Years of Experience for the NP	A listing of the years of experience for each NP.	Continuous

Data Analysis

The unit of analysis was the patient visit defined as an interaction between the NP and the patient. For each CPT code, several different ICD codes may be assigned. This study considered only those commonly assigned ICD codes for each CPT code for analysis. Small counts of rarely assigned ICD and CPT codes in the data prohibit reliable data analysis. Therefore, combinations of ICD and CPT codes that occur less than 15 times were excluded from the analysis.

Univariate analyses were used to describe the sample data for this study exploring the underlying distribution of the data. Pearson's correlation coefficient was calculated to quantify the strength of the relationship between the variables of interest. An

independent samples t-test was conducted to compare mean time for the NP to assign CPT codes, by gender and student status. A one-way analysis of variance (ANOVA) was performed to assess the difference in time for the NP to assign CPT code between CPT codes. An additional ANOVA was performed to assess the difference in time for the NP to assign ICD code between ICD codes. If, the ANOVA results show statistically significant outcomes, a post-hoc comparison using Fisher's LSD analysis was conducted to further review the specific differences.

A multivariate linear regression analysis was performed to examine the relationship between the number of the Number of Additional Secondary ICD Codes Assigned, Patient Residency Status, Patient Age, Patient Gender and Years of Experience for the NP. The regression model is as follows:

$$Y = \beta_0 + \beta_1 x_1 + \sum_{i=2}^{5} \beta_i x_i$$

Where:

X_1 = Number of Additional Secondary ICD codes (the number of additional ICD codes assigned to a patient visit)

X_2 = Patient Residency Status (domestic or international)

X_3 = Patient Age

X_4 = Patient Gender

X_5 = Years of Experience for the NP

Y = Time for NP to Assign CPT code

Each of the ICD codes was analyzed with the above multivariate linear regression model. The complete dataset was divided into individual datasets with the ICD code being the primary identifier of those individual datasets. This resulted in 15 datasets, one for each of the ICD codes. Within each of the 15 individual datasets identified by the ICD code, multivariate linear regression analyses were conducted on any CPT code with 15 or more cases. Thus, a total of 19 multivariate regression analyses were performed.

Table 10 provides a summary of the individual datasets created by ICD codes and the CPT codes for which multivariate linear regression analyses were conducted. A description of the CPT codes and ICD codes used is provided in Tables 11 and 12, respectively. All data analysis was conducted using SPSS version 21.

Table 10
Summary of ICD Codes and CPT Codes Selected for Analyses

	ICD Codes	CPT Codes					
		99202	99203	99204	99212	99213	99214
1)	300.00	0	7	2	1	12	11
2)	462	2	50*	0	1	33*	25*
3)	465.9	2	60*	1	1	27*	19*
4)	477.9	2	43*	1	1	39*	18*
5)	558.9	0	9	0	0	11	9
6)	599	0	22*	0	0	17*	9
7)	616.1	0	21*	0	0	16*	27*
8)	623.5	0	9	1	0	7	14
9)	626.4	2	12	0	2	13	7
10)	782.1	2	9	0	2	10	8
11)	788.1	3	10	0	1	9	11
12)	V25.01	13	24*	1	1	14	15*
13)	V25.09	3	10	0	3	33*	5
14)	V25.41	1	10	0	5	20*	13
15)	V25.49	2	0	0	15*	6	2

* Combination of CPT codes and ICD codes analyzed for 15 or more cases.

Table 11
Description of CPT Codes

CPT Code	CPT Code Description
99201	New Patient - Level 1
99202	New Patient - Level 2
99203	New Patient - Level 3
99204	New Patient - Level 4
99205	New Patient - Level 5
99211	Established Patient - Level 1
99212	Established Patient - Level 2
99213	Established Patient - Level 3
99214	Established Patient - Level 4
99215	Established Patient - Level 5

Table 12

Description of ICD Codes

ICD Code	ICD Code Description
300.00	Anxiety state, unspecified
462	Acute pharyngitis
465.9	Acute upper respiratory infections of unspecified site
477.9	Allergic rhinitis, cause unspecified
558.9	Other and unspecified noninfectious gastroenteritis and colitis
599.0	Urinary tract infection, site not specified
616.10	Vaginitis and vulvovaginitis, unspecified
623.5	Leukorrhea, not specified as infective
626.4	Irregular menstrual cycle
782.1	Rash and other nonspecific skin eruption
788.1	Dysuria
V25.01	General counseling on prescription of oral contraceptives
V25.09	Other general counseling and advice on contraceptive management
V25.41	Surveillance of contraceptive pill
V25.49	Surveillance of contraceptive method

CHAPTER 4

RESULTS

The goal of this dissertation was to discover which factors within the daily practice of NPs contributed to the productive efficiency in NMCs. In this chapter the results of the analyses defined in Chapter 3 are presented. This chapter begins with the presentation of the descriptive statistics for the complete dataset. Followed by the presentation of the bivariate results. The chapter concludes with the presentation of the results from the 19 multivariate linear regression analyses for each combination of ICD code and CPT code selected.

Descriptive Statistics

There were a total of 851 cases provided in the sample. Of the 851 total cases, 23 cases were eliminated from consideration as these cases had a modifier 25 attached to the CPT Code. Lastly, of the 851 total cases, one case labeled as CPT Code 99215 (Established Patient - Level 5) was eliminated as it only occurred once and did not provide enough sample data to be included in statistical calculations. This resulted in a final total of 827 cases that were included in the analysis. The inclusion and exclusion criteria are displayed in Figure 4.

The overall descriptive statistics are presented in Table 13. The mean patient age was 23.57 (SD = 5.16), the mean years of experience of the NPs was 10.02 (SD = 7.23),

and the mean time for the NPs to assign CPT code was 43.22 (SD = 25.57) minutes. Of the 827 cases, 196 (23.7%) cases were males and 631 (76.3%) cases were females. There were 601 (72.7%) domestic students and 226 (27.3%) international students.

Three CPT codes accounted for more than 91% of all 827 cases. Of these 827 cases, 296 (35.8%) cases, were labeled with the CPT code 99203 (New Patient – Level 3), followed by the CPT code 99213 (Established Patient – Level 3) with 267 (32.3%) cases, and lastly, by the CPT code 99214 (Established Patient – Level 4) with 193 (23.3%) cases.

Three ICD codes accounted for more than 39% of all cases. Of the 827 cases, 111 (13.4%) cases, were labeled with the ICD code 465.9 (acute upper respiratory infections of unspecified site), followed by the ICD code 462 (acute pharyngitis) with 110 (13.3%) cases, and lastly, by the ICD code 477.9 (allergic rhinitis, cause unspecified) with 104 (12.6%) cases.

Of the 827 cases, 587 (71.0%) cases were managed by ANPs, and 240 (29.0%) cases were managed by FNPs. Furthermore, 332 (40.1%) cases did not have any additional secondary ICD codes assigned beyond their primary ICD code. Another 267 (32.3%) cases had one additional secondary ICD code beyond the primary ICD code, and 141 (17.0%) cases had two additional secondary ICD codes beyond the primary ICD code. These accounted for nearly 90% of all cases that had additional secondary ICD codes assigned beyond the primary ICD code.

Table 13
Descriptive Statistics for All Patients

	Mean (SD)
Patient Age	23.57 (5.16)
Years of Experience for the NP	10.02 (7.23)
Time for the NP to Assign CPT Code (minutes), in total	43.22 (25.57)
	Count (%)
Patient Gender	
Female	631 (76.3)
Male	196 (23.7)
Patient Residency Status	
Domestic	601 (72.7)
International	226 (27.3)
CPT Codes	
New Patient - Level 3 (99203)	296 (35.8)
Established Patient - Level 3 (99213)	267 (32.3)
Established Patient - Level 4 (99214)	193 (23.3)
Established Patient - Level 2 (99212)	33 (4.0)
New Patient - Level 2 (99202)	32 (3.9)
New Patient - Level 4 (99204)	6 (0.7)
ICD Codes	
Acute pharyngitis (462)	111 (13.4)
Acute upper respiratory infections of unspecified site (465.9)	110 (13.3)
Allergic rhinitis, cause unspecified (477.9)	104 (12.6)
General counseling on prescription of oral contraceptives (V25.01)	68 (8.2)
Vaginitis and vulvovaginitis, unspecified (616.10)	64 (7.7)
Other general counseling and advice on contraceptive management (V25.09)	54 (6.5)
Surveillance of contraceptive pill (V25.41)	49 (5.9)
Urinary tract infection, site not specified (599.0)	48 (5.8)
Irregular menstrual cycle (626.4)	36 (4.4)
Dysuria (788.1)	34 (4.1)
Anxiety State, unspecified (300.00)	33 (4.0)
Leukorrhea, not specified as infective (623.5)	31 (3.7)

Continued on next page

ICD Codes	Count (%)
Rash and other nonspecific skin eruption (782.1)	31 (3.7)
Other and unspecified noninfectious gastroenteritis and colitis (558.9)	29 (3.5)
Surveillance of other contraceptive method (V25.49)	25 (3.0)
Type of Nurse Practitioner	
Adult NP	587 (71.0)
Family NP	240 (29.0)
Total Number of Additional ICD Codes	
0	332 (40.1)
1	267 (32.3)
2	141 (17.0)
3	58 (7.0)
4	21 (2.5)
5	8 (1.0)
Total Number of Additional CPT Codes	
0	357 (43.2)
1	256 (31.0)
2	135 (16.3)
3	40 (4.8)
4	25 (3.0)
5	12 (1.5)
6	2 (0.2)

Bivariate Analysis

A means test was conducted on time for the NP to assign code for CPT codes and ICD codes. The CPT code 99212 (Established Patient - Level 2) took the least time at 31 minutes (SD = 20.16). While, the CPT code 99203 (New Patient - Level 3) took the most time at 47.32 minutes (SD = 30.10). The ICD code V25.41 (Surveillance of contraceptive pill) was designated with the shortest time at 34.65 minutes (SD = 16.47).

While, ICD code 626.4 (Irregular menstrual cycle) took the most time at 56.77 minutes (SD = 30.06).

The Pearson correlation coefficient was used to quantify the strength of relationships between the variables of interest. There was a positive correlation between Time for the NP to Assign CPT Code and Additional ICD Codes ($r = 0.25$ and $p < 0.01$). There was a negative correlation between Time for the NP to Assign CPT Code and Years of Experience ($r = -0.13$ and $p < 0.01$). There was a negative correlation between Additional ICD Codes and Years of Experience ($r = -0.23$ and $p < 0.01$). While these correlations were found to be statistically significant, the relationships were determined to be weak. A summary of these results can be found in Table 14.

Table 14
Pearson Correlation

	Time For the NP to Assign CPT Code	Total Number of Additional Codes ICD Codes	Patient Age	Years of Experience for the NP
r				
Time for the NP to Assign CPT Code	1	0.25**	-0.12	-0.13**
Total Number of Additional Codes ICD Codes	0.25**	1	-0.32	-0.23**
Patient Age	-0.12	-0.32	1	0.05
Years of Experience for the NP	-0.13**	-0.23**	0.05	1

* Pearson Correlation is significant at the 0.05 level (2-tailed).

** Pearson Correlation is significant at the 0.01 level (2-tailed).

An independent samples t-test was conducted to compare mean time for the NP to assign CPT codes, by gender and student status. The mean time for the NP to assign CPT Codes for males was 42.02 minutes (SD = 21.54) and 43.59 minutes for females (SD = 26.71), but the difference was not statistically significant. The mean time for the NP to assign CPT Codes for domestic students was 42.05 minutes (SD = 22.78) and 46.31 minutes for international students (SD = 31.68). This difference was found to be statistically significant ($p < 0.05$). A summary is provided in Table 15.

Table 15
Independent samples t-test

	Sample	Time for the NP to Assign CPT Code (minutes)			
		N	Mean	SD	P value
Gender	Male	196	42.02	21.54	0.45
	Female	631	43.59	26.71	
Student Status	Domestic	601	42.05	22.78	0.03
	International	226	46.31	31.68	

A one way analysis of variance (ANOVA) analysis was conducted to assess the difference in Time for the NP to Assign CPT Codes among the 6 different CPT codes. Results showed a statistically significant difference in Time for the NP to Assign CPT Codes ($p < 0.01$). For example, the mean time for the NP to assign CPT code 99202 (New Patient - Level 2) was 32.28 minutes whereas, the mean time for the NP to assign CPT code 99212 (Established Patient - Level 2) was 31 minutes. A summary is provided in Table 16.

Table 16
Analysis of variance for CPT codes

	Sample	Time for the NP to Assign CPT Code (minutes)			
		N	Mean	SD	P value
CPT Codes	99202	32	32.28	14.65	< 0.01
	99203	296	47.32	30.10	
	99204	6	93.5	43.40	
	99212	33	31	20.16	
	99213	267	38.65	21.61	
	99214	193	45.5	21.33	

A post-hoc comparison using Fisher's LSD analysis showed a statistically significant difference across various combinations of CPT codes in Time for the NP to Assign CPT Code.

CPT Code 99202 (New Patient - Level 2) was statistically different from CPT codes 99203 (New Patient - Level 3), 99204 (New Patient - Level 4) and 99214 (Established Patient - Level 4).

CPT code 99203 (New Patient - Level 3) was statistically different from CPT codes 99202 (New Patient - Level 2), 99204 (New Patient - Level 4), 99212 (Established Patient - Level 2) and 99213 (Established Patient - Level 3).

CPT code 99204 (New Patient - Level 4) was statistically different from CPT codes 99202 (New Patient - Level 2), 99203 (New Patient - Level 3), 99212 (Established Patient - Level 2), 99213 (Established Patient - Level 3) and 99214 (Established Patient - Level 4).

CPT code 99212 (Established Patient - Level 2) was statistically different from 99203 (New Patient - Level 3), 99204 (New Patient - Level 4) and 99214 (Established Patient - Level 4).

CPT code 99213 (Established Patient - Level 3) was statistically different from 99203 (New Patient - Level 3), 99204 (New Patient - Level 4) and 99214 (Established Patient - Level 4).

CPT code 99214 (Established Patient - Level 4) was statistically different from CPT codes 99202 (New Patient - Level 2), 99204 (New Patient - Level 4), 99212 (Established Patient - Level 2) and 99213 (Established Patient - Level 3).

In summary, with each advancing CPT code, for example from CPT code 99203 (New Patient - Level 3) to CPT code 99214 (Established Patient - Level 4), the time for the NP to assign CPT code increased. The CPT code 99204 (New Patient - Level 4) exceeded the norm at 93.5 minutes (SD = 43.40) and thus, was very different in time for the NP to assign other CPT codes.

An additional ANOVA was conducted to assess the differences in Time for the NP to Assign ICD code among the 15 different ICD codes. The analysis revealed a statistically significant difference in Time for the NP to Assign ICD code ($p < 0.01$). On average, for example, it takes 41.02 minutes for the NP to assign ICD code 300.00 (Anxiety state, unspecified) as compared to 40.61 minutes for the NP to assign ICD code 462 (Acute pharyngitis). A summary is provided in Table 17 for the ICD codes assessed in this study.

Table 17
Analysis of variance for ICD codes

	Sample	Time for the NP to Assign ICD Code (minutes)			
		N	Mean	SD	P value
ICD Codes	300.00	35	41.02	21.58	
	462.0	106	40.61	21.74	
	465.90	110	39.96	19.48	
	477.9	103	53.88	25.79	
	558.9	30	46.23	26.55	
	599	49	45.49	20.24	
	616.1	65	44.76	45.68	
	623.5	29	42.51	37.49	< 0.01
	626.4	36	56.77	30.06	
	782.1	32	47.40	20.05	
	788.1	34	40.61	17.57	
	V25.01	68	35.35	17.40	
	V25.09	55	40.10	19.40	
	V25.41	49	34.65	16.47	
	V25.49	26	40.34	23.76	

A post-hoc comparison using Fisher's LSD analysis showed a statistically significant difference across various combinations of ICD codes in Time for the NP to Assign ICD Code.

ICD Code 300.00 (Anxiety state, unspecified) was statistically different from ICD Codes 477.9 (Allergic rhinitis, cause unspecified) and 626.4 (Irregular menstrual cycle).

ICD Code 462 (Acute pharyngitis) was statistically different from ICD Codes 477.9 (Allergic rhinitis, cause unspecified) and 626.4 (Irregular menstrual cycle).

ICD Code 465.9 (Acute upper respiratory infections of unspecified site) was statistically different from ICD Codes 477.9 (Allergic rhinitis, cause unspecified) and 626.4 (Irregular menstrual cycle).

ICD Code 477.9 (Allergic rhinitis, cause unspecified) was statistically different from ICD Codes 300.00 (Anxiety state, unspecified), 462 (Acute pharyngitis), 465.9

(Acute upper respiratory infections of unspecified site), 616.10 (Vaginitis and vulvovaginitis, unspecified), 623.5 (Leukorrhea, not specified as infective), 788.1 (Dysuria), V25.01 (General counseling on prescription of oral contraceptives), V25.09 (Other general counseling and advice on contraceptive management), V25.41 (Surveillance of contraceptive pill) and V25.49 (Surveillance of other contraceptive method).

ICD code 558.9 (Other and unspecified non-infectious gastroenteritis and colitis) was statistically different from ICD codes 626.4 (Irregular menstrual cycle), V25.01 (General counseling on prescription of oral contraceptives) and V25.41 (Surveillance of contraceptive pill).

ICD code 599.0 (Urinary tract infection, site not specified) was statistically different from ICD codes 626.4 (Irregular menstrual cycle), V25.01 (General counseling on prescription of oral contraceptives) and V25.41 (General counseling on prescription of oral contraceptives).

ICD code 616.10 (Vaginitis and vulvovaginitis, unspecified) was statistically different from ICD codes 477.9 (Allergic rhinitis, cause unspecified), 626.4 (Irregular menstrual cycle), V25.01 (General counseling on prescription of oral contraceptives) and V25.49 (Surveillance of other contraceptive method).

ICD code 623.50 (Leukorrhea, not specified as infective) was statistically different from ICD codes 477.9 (Allergic rhinitis, cause unspecified) and 626.4 (Irregular menstrual cycle).

ICD code 626.4 (Irregular menstrual cycle) was statistically different from ICD codes 300.00 (Anxiety state, unspecified), 462 (Acute pharyngitis), 465.9 (Acute upper

respiratory infections of unspecified site), 599.0 (Urinary tract infection, site not specified) , 616.10 (Vaginitis and vulvovaginitis, unspecified), 623.5 (Leukorrhea, not specified as infective), 788.1 (Dysuria), V25.01 (General counseling on prescription of oral contraceptives), V25.09 (Other general counseling and advice on contraceptive management), V25.41 (Surveillance of contraceptive pill) and V25.49 (Surveillance of other contraceptive method).

ICD code 782.1 (Rash and other non-specific skin eruption) was statistically different from ICD codes V25.01 (General counseling on prescription of oral contraceptives) and V25.41 (Surveillance of contraceptive pill).

ICD code 788.1 (Dysuria) was statistically different from ICD codes 477.9 (Allergic rhinitis, cause unspecified) and 626.4 (Irregular menstrual cycle).

ICD code V25.01 (General counseling on prescription of oral contraceptives) was statistically different from ICD codes 477.9 (Allergic rhinitis, cause unspecified), 558.9 (Other and unspecified non-infectious gastroenteritis and colitis), 599.0 (Urinary tract infection, site not specified), 616.10 (Vaginitis and vulvovaginitis, unspecified), 626.4 (Irregular menstrual cycle) and 782.1 (Rash and other non-specific skin eruption).

ICD code V25.09 (Other general counseling and advice on contraceptive management) was statistically different from ICD codes 477.9 (Allergic rhinitis, cause unspecified) and 626.4 (Irregular menstrual cycle).

ICD code V25.41 (Surveillance of contraceptive pill) was statistically different from ICD codes 477.9 (Allergic rhinitis, cause unspecified), 558.9 (Other and unspecified non-infectious gastroenteritis and colitis), 599.0 (Urinary tract infection, site not

specified), 616.10 (Vaginitis and vulvovaginitis, unspecified), 626.4 (Irregular menstrual cycle) and782.1 (Rash and other non-specific skin eruption).

ICD code V25.49 (Surveillance of other contraceptive method) was statistically different from ICD codes 477.9 (Allergic rhinitis, cause unspecified) and 626.4 (Irregular menstrual cycle).

In summary, the ICD codes of 626.4 (Irregular menstrual cycle) and 477.9 (Allergic rhinitis, cause unspecified) had the first and second greatest time for the NP to assign codes of all the ICD codes measured, respectively. In turn, these two ICD codes exceeded 53 minutes on average to assign codes and were statistically different from 11 and 10 other ICD codes, respectively.

Multivariate Regression Analysis

A multivariate linear regression analysis was conducted for each of the 15 ICD codes and the corresponding 6 CPT codes. This process was repeated for each of the five hypotheses, which resulted in a final total of 19 regression analyses. A summary of the combination of CPT codes and ICD codes selected for multivariate linear regression analysis is provided in Table 10. The results of the multivariate linear regression analyses provided in the remainder of this chapter tested the following hypotheses with Time for the NP to Assign CPT Code being the outcome variable of interest.

Hypothesis 1: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* based on the number of additional secondary ICD codes assigned, while controlling for Patient Residency Status, Patient Age, Patient Gender and Years of Experience for the NP.

Hypothesis 2: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for International Patient Status, while controlling for the number of additional secondary ICD codes assigned, Patient Age, Patient Gender and Years of Experience for the NP.

Hypothesis 3: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for increasing Patient Age, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Gender and Years of Experience for the NP.

Hypothesis 4: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *different* based on Patient Gender, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Years of Experience for the NP.

Hypothesis 5: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *lower* for increasing Years of Experience of the NP while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Patient Gender.

(1) ICD Code 462 (Acute Pharyngitis)

Multivariate linear regression was conducted for ICD code 462 (Acute pharyngitis) for CPT codes 99203 (New Patient – Level 3) and 99213 (Established Patient – Level 3). No significance was noted for hypotheses 1 through 5, thus we find no support for any of these hypotheses.

Multivariate linear regression was conducted for ICD code 462 (Acute pharyngitis) for CPT code 99214 (Established Patient - Level 4) for hypotheses 1 through 5. No significance was noted for hypotheses 1 through 4, thus we find no support for these hypotheses. Whereas, for hypothesis 5, Years of Experience ($p < 0.05$) was significantly associated with time for the NP to assign code for CPT code 99214 (Established Patient - Level 4).

Specifically, each year of additional experience is associated with 1.22 fewer minutes for the NP to assign CPT code 99214 (Established Patient - Level 4), while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Patient Gender. Furthermore, an R^2 value of 0.35 suggests that the analysis explains 35% of the variation. A summary is provided in Table 18.

Table 18
ICD code 462 (Acute pharyngitis)

Hypothesis 1 -5	CPT 99203			CPT 99213			CPT 99214		
	β	t	p-value	β	t	p-value	β	t	p-value
Intercept	51.40	3.84	0.00	22.80	1.57	0.12	67.13	2.26	0.03
Additional Secondary ICD Codes	2.17	0.85	0.39	8.69	1.64	0.11	1.17	0.29	0.76
International Student	6.86	1.17	0.24	9.68	1.28	0.20	0.25	0.31	0.97
Age	-0.69	-1.24	0.24	0.19	0.33	0.74	-0.43	-0.31	0.75
Gender (Female)	2.82	0.59	0.55	-0.60	-0.09	0.92	-6.68	-0.91	0.37
Years of Experience	0.27	0.84	0.40	0.39	0.59	0.56	-1.22	-2.43	0.02*
R^2	0.08			0.17			0.35		

(2) ICD Code 465.9 (Acute Respiratory Infection of Unspecified Site)

Multivariate linear regression was conducted for ICD code 465.9 (Acute upper respiratory infections of unspecified site) for CPT codes 99203 (New Patient - Level 3), 99213 (Established Patient - Level 3), and 99214 (Established Patient - Level 4) for hypothesis 1 through 5. No significance was noted for hypotheses 1 through 5, thus we find no support for any of the hypotheses. A summary is provided in Table 19.

Table 19

ICD code 465.9 (Acute upper respiratory infections of unspecified site)

Hypotheses 1 - 5	CPT 99203			CPT 99213			CPT 99214		
	β	t	p-value	β	t	p-value	β	t	p-value
Intercept	62.41	1.91	0.06	29.81	1.59	0.12	33.85	0.78	0.44
Additional Secondary ICD Codes	-3.39	-0.55	0.58	-1.80	-0.76	0.45	3.81	0.80	0.43
International Student	22.82	1.54	0.12	-5.01	-1.11	0.27	12.28	1.20	0.25
Age	-1.21	-0.91	0.36	0.18	0.21	0.82	-0.09	-0.07	0.94
Gender (Female)	10.98	0.89	0.37	-1.64	-0.37	0.70	2.28	0.17	0.86
Years of Experience	0.15	0.17	0.86	-0.29	-0.91	0.37	-0.53	-0.96	0.35
R^2	0.05			0.09			0.26		

(3) ICD Code 477.9 (Allergic Rhinitis, Cause Unspecified)

Multivariate linear regression was conducted for ICD code 477.9 (Allergic rhinitis, cause unspecified) for CPT codes 99213 (Established Patient - Level 3), and 99214 (Established Patient - Level 4) for hypothesis 1 through 5. No significance was noted for hypotheses 1 through 5, thus we find no support for any of the hypotheses.

Multivariate linear regression was conducted for ICD code 477.9 (Allergic rhinitis, cause unspecified) for CPT code 99203 (New Patient - Level 3), for hypothesis 1 through 5. No significance was noted for hypotheses 1 through 3 and 5, thus we find no support for these hypotheses. Whereas, for hypothesis 4, Gender ($p < 0.05$) was significantly associated with time for the NP to assign code for CPT code 99203 (New Patient - Level 3).

Specifically, gender is associated with 14.73 fewer minutes for NP to assign CPT code 99203 (New Patient - Level 3) for females than males, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Years of Experience for the NP. Furthermore, an R^2 value of 0.18 suggests that the analysis explains 18% of the variation. A summary is provided in Table 20.

Table 20
ICD code 477.9 (Allergic rhinitis, cause unspecified)

Hypotheses 1 - 5	CPT 99203			CPT 99213			CPT 99214		
	β	t	p-value	β	t	p-value	β	t	p-value
Intercept	57.60	3.85	0.00	27.10	1.55	0.12	52.97	1.03	0.32
Additional Secondary ICD Codes	3.57	1.27	0.21	6.10	1.15	0.25	-1.43	-0.24	0.80
International Student	-3.32	-0.53	0.59	-1.25	-0.13	0.89	3.07	0.22	0.82
Age	-0.65	-1.23	0.22	0.25	0.68	0.50	0.24	0.20	0.84
Gender (Female)	-14.73	-2.35	0.02*	3.14	0.35	0.72	7.47	0.27	0.79
Years of Experience	0.33	0.64	0.52	-0.18	-0.18	0.85	-1.80	-1.94	0.07
R^2	0.18			0.07			0.26		

(4) ICD Code 599.0 (Urinary Tract Infection, Site Not Specified)

Multivariate linear regression was conducted for ICD code 599.0 (Urinary tract infection, site not specified) for CPT codes 99203 (New Patient - Level 3) and 99213

(Established Patient - Level 3) for hypothesis 1 through 5. No significance was noted for hypotheses 1 through 5, thus we find no support for any of the hypotheses.

Gender was excluded from the regression model for CPT codes 99203 (New Patient - Level 3) and 99213 (Established Patient - Level 3), because all patients were of the same gender (female). A summary is provided in Table 21.

Table 21
ICD code 599.0 (Urinary tract infection, site not specified)

Hypotheses 1 - 5	CPT 99203			CPT 99213		
	β	t	p-value	β	t	p-value
Intercept	34.19	2.17	0.04	15.32	0.49	0.63
Additional Secondary ICD Codes	4.68	1.33	0.19	8.51	1.62	0.13
International Student	1.08	0.13	0.89	-2.56	-0.21	0.83
Age	-0.25	-0.53	0.89	0.18	0.16	0.87
Gender (Female)	-	-	-	-	-	-
Years of Experience	-0.32	-0.37	0.71	0.95	1.01	0.33
R^2	0.22			0.20		

(5) ICD Code 616.10 (Vaginitis and Vulvovaginitis, Unspecified)

Multivariate linear regression was conducted for ICD code 616.10 (Vaginitis and vulvovaginitis, unspecified) for CPT codes 99203 (New Patient - Level 3), 99213 (Established Patient - Level 3), and 99214 (Established Patient - Level 4) for hypothesis 1

through 5. No significance was noted for hypotheses 1 through 5, thus we find no support for any of the hypotheses.

Gender was excluded from the regression model for CPT codes 99203 (New Patient - Level 3), 99213 (Established Patient - Level 3), and 99214 (Established Patient - Level 4), because all patients were of the same gender (female). A summary is provided in Table 22.

Table 22
ICD code 616.10 (Vaginitis and vulvovaginitis, unspecified)

Hypotheses 1 - 5	CPT 99203			CPT 99213			CPT 99214		
	β	t	p-value	β	t	p-value	β	t	p-value
Intercept	122.61	2.08	0.05	76.89	2.49	0.03	52.68	2.58	0.01
Additional Secondary ICD Codes	-4.23	-0.63	0.53	0.35	0.07	0.94	6.85	1.92	0.06
International Student	14.22	0.62	0.54	-6.69	-0.79	0.44	-21.75	-1.93	0.06
Age	-1.65	-0.76	0.45	-0.96	-0.81	0.43	-0.21	-0.28	0.77
Gender (Female)	-	-	-	-	-	-	-	-	-
Years of Experience	-1.31	-1.13	0.27	-1.19	-1.83	0.09	-0.87	-1.41	0.17
R^2	0.10			0.35			0.43		

(6) ICD Code V25.01 (General Counseling on Prescription of Oral Contraceptives)

Multivariate linear regression was conducted for ICD code V25.01 (General counseling on prescription of oral contraceptives) for CPT codes 99203 (New Patient - Level 3) for hypothesis 1 through 5. No significance was noted for hypotheses 1 through

5 for CPT code 99203 (New Patient - Level 3), thus we find no support for any of the hypotheses.

Multivariate linear regression was conducted for ICD code V25.01 (General counseling on prescription of oral contraceptives) for CPT codes 99214 (Established Patient - Level 4) for hypothesis 1 through 5. No significance was noted for hypotheses 1- 4, thus we find no support for any of these hypotheses. Whereas, for hypothesis 5, Years of Experience ($p < 0.001$) was significantly associated with time for the NP to assign code for CPT code 99214 (Established Patient - Level 4).

Specifically, each year of additional experience is associated with 1.86 fewer minutes for the NP to assign CPT code 99214 (Established Patient - Level 4), while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Patient Gender. Furthermore, an R^2 value of 0.82 suggests that the analysis explains 82% of the variation.

Gender was excluded from the regression model for CPT codes 99203 (New Patient - Level 3), and 99214 (Established Patient - Level 4), because all patients were of the same gender (female). A summary is provided in Table 23.

Table 23
ICD code V25.01 (General counseling on prescription of oral contraceptives)

Hypotheses 1 - 5	CPT 99203			CPT 99214		
	β	t	p-value	β	t	p-value
Intercept	51.37	2.00	0.05	13.53	0.53	0.60
Additional Secondary ICD Codes	6.44	1.41	0.17	4.67	1.49	0.16
International Student	-1.66	-0.17	0.86	5.39	0.65	0.52
Age	0.11	0.10	0.92	1.90	1.83	0.09
Gender (Female)	-	-	-	-	-	-
Years of Experience	-0.34	-0.57	0.57	-1.86	-4.73	< 0.001
R^2	0.09			0.82		

(7) ICD Code V25.09 (Other General Counseling and Advice on Contraceptive Management)

Multivariate linear regression was conducted for ICD code V25.09 (Other general counseling and advice on contraceptive management) for CPT code 99213 (Established Patient - Level 3) for hypothesis 1 through 5. No significance was noted for hypotheses 1 through 5, thus we found no support for any of the hypotheses.

Gender was excluded from the regression model for CPT code 99213 (Established Patient - Level 3), because all patients were of the same gender (female). A summary is provided in Table 24.

Table 24

ICD code V25.09 (Other general counseling and advice on contraceptive management)

Hypotheses 1 - 5	CPT 99213		
	β	t	p-value
Intercept	20.61	0.82	0.41
Additional Secondary ICD Codes	6.84	1.86	0.07
International Student	10.04	0.98	0.33
Age	-0.13	-0.13	0.89
Gender (Female)	-	-	-
Years of Experience	1.38	1.78	0.08
R^2	0.19		

(8) ICD Code V25.41 (Surveillance of Contraceptive Pill)

Multivariate linear regression was conducted for ICD code V25.41 (Surveillance of contraceptive pill) for CPT code 99213 (Established Patient - Level 3), for hypotheses 1 through 5. No significance was noted for hypotheses 1 through 5, thus we found no support for any of the hypotheses.

Gender was excluded from the regression model for CPT code 99213 (Established Patient - Level 3), because all patients were of the same gender (female). A summary is provided in Table 25.

Table 25
ICD code V25.41 (Surveillance of contraceptive pill)

Hypotheses 1 - 5	CPT 99213		
	β	t	p-value
Intercept	137.90	1.69	0.11
Additional Secondary ICD Codes	10.03	1.15	0.26
International Student	12.16	0.42	0.67
Age	-4.49	-1.34	0.19
Gender (Female)	-	-	-
Years of Experience	-0.67	-0.62	0.54
R^2	0.23		

(9) ICD Code V25.49 (Surveillance of Other Contraceptive Method)

Multivariate linear regression was conducted for ICD code V25.49 (Surveillance of other contraceptive method) for CPT code 99212 (Established Patient - Level 2) for hypothesis 1 through 5. No significance was noted for hypotheses 2 through 5, thus we found no support for any of these hypotheses. Whereas, for hypothesis 1, Additional Secondary ICD Codes ($p < 0.01$) was significantly associated with time for the NP to assign CPT code for CPT code 99212 (Established Patient - Level 2).

Specifically, additional ICD code is associated with 20.82 additional minutes for the NP to assign CPT code 99212 (Established Patient - Level 2), while controlling for Patient Residency Status, Patient Age, Patient Gender and Years of Experience for the NP. Furthermore, an R^2 value of 0.49 suggests that the analysis explains 49% of the variation.

Student Status was excluded from the regression model for CPT code 99212 (Established Patient - Level 2), because all patients were of the same student status (domestic). Gender was excluded from the regression model for CPT code 99212 (Established Patient - Level 2), because all patients were of the same gender (female) and the same student status (domestic). A summary is provided in Table 26.

Table 26
ICD code V25.49 (Surveillance of other contraceptive method)

Hypotheses 1 - 5	CPT 99212		
	β	t	p-value
Intercept	59.56	0.88	0.39
Additional Secondary ICD Codes	20.82	3.05	< 0.01
International Student	-	-	-
Age	-2.95	-0.98	0.34
Gender (Female)	-	-	-
Years of Experience	1.34	1.22	0.24
R^2	0.49		

A summary of the multivariate linear regression analyses mentioned above is provided in Table 27. A summary of the predictors of time for the NP to assign CPT code is provided in Table 28.

Table 27
Summary of Multivariate Linear Regression Analyses – Beta Values

		CPT Code			
		99203	99212	99213	99214
ICD Code	Variables	Hypotheses 1- 5			
Acute pharyngitis (462)					
	Number of Additional Secondary ICD Codes	2.17		8.69	1.17
	International Student	6.86		9.68	0.25
	Patient Age	-0.69		0.19	-0.43
	Patient Gender	2.82		-0.60	-6.68
	Years of Experience for the NP	0.27		0.39	-1.22*
Acute upper respiratory infections of unspecified site (465.9)					
	Number of Additional Secondary ICD Codes	-3.39		-1.80	3.81
	International Student	22.82		-5.01	12.28
	Patient Age	-1.21		0.18	-0.09
	Patient Gender	10.98		-1.64	2.28
	Years of Experience for the NP	0.15		-0.29	-0.53

Continued on next page

		CPT Code			
		99203	99212	99213	99214
ICD Code	Variables	Hypotheses 1- 5			
Allergic rhinitis, cause unspecified (477.9)					
	Number of Additional Secondary ICD Codes	3.57		6.10	-1.43
	International Student	-3.32		-1.25	3.07
	Patient Age	-0.65		0.25	0.24
	Patient Gender	-14.73*		3.14	7.47
	Years of Experience for the NP	0.33		-0.18	-1.80
Urinary tract infection, site not specified (599.0)					
	Number of Additional Secondary ICD Codes	4.68		8.51	
	International Student	1.08		-2.56	
	Patient Age	-0.25		0.18	
	Patient Gender	-		-	
	Years of Experience for the NP	-0.32		0.95	

Continued on next page

		CPT Code			
		99203	99212	99213	99214
ICD Code	Variables	Hypotheses 1- 5			
Vaginitis and vulvovaginitis, unspecified (616.10)					
	Number of Additional Secondary ICD Codes	-4.23		0.35	6.85
	International Student	14.22		-6.69	-21.75
	Patient Age	-1.65		-0.96	-0.21
	Patient Gender	-		-	-
	Years of Experience for the NP	-1.31		-1.19	-0.87
General counseling on prescription of oral contraceptives (V25.01)					
	Number of Additional Secondary ICD Codes	6.44			4.67
	International Student	-1.66			5.39
	Patient Age	0.11			1.90
	Patient Gender	-			-
	Years of Experience for the NP	-0.34			-1.86***

Continued on next page

		CPT Code			
		99203	99212	99213	99214
ICD Code	Variables	Hypotheses 1- 5			
Other general counseling and advice on contraceptive management (V25.09)					
	Number of Additional Secondary ICD Codes			6.84	
	International Student			10.04	
	Patient Age			-0.13	
	Patient Gender			-	
	Years of Experience for the NP			1.38	
Surveillance of contraceptive pill (V25.41)					
	Number of Additional Secondary ICD Codes			10.03	
	International Student			12.16	
	Patient Age			-4.49	
	Patient Gender			-	
	Years of Experience for the NP			-0.67	

Continued on next page

		CPT Code			
		99203	99212	99213	99214
ICD Code	Variables	Hypotheses 1- 5			
Surveillance of other contraceptive method (V25.49)					
	Number of Additional Secondary ICD Codes		20.82**		
	International Student		-		
	Patient Age		-2.95		
	Patient Gender		-		
	Years of Experience for the NP		1.34		

* p < 0.05;** p < 0.01; *** p < 0.001

Table 28

Summary of Predictors of Time for the NP to Assign CPT Code

	CPT Code			
	99203	99212	99213	99214
	Hypotheses 1 - 5			
ICD Code				
Acute pharyngitis (462)				Years of Experience for the NP *
Acute upper respiratory infections of unspecified site (465.9)				
Allergic rhinitis, cause unspecified (477.9)	Patient Gender *			
Urinary tract infection, site not specified (599.0)				
Vaginitis and vulvovaginitis, unspecified (616.10)				
General counseling on prescription of oral contraceptives (V25.01)				Years of Experience for the NP ***
Other general counseling and advice on contraceptive management (V25.09)				
Surveillance of contraceptive pill (V25.41)				
Surveillance of other contraceptive method (V25.49)		Additional ICD Codes **		

* $p < 0.05$;** $p < 0.01$; *** $p < 0.001$

CHAPTER 5

DISCUSSION

The purpose of this study was to determine the level of productive efficiency of Nurse Practitioners (NP) in a Nurse Managed Center (NMC) in a highly restrictive scope-of-practice (SOP) state. The theories of Complex Adaptive Systems (CAS) and Resource Based View (RBV) framed the research question for this study and led to the development of the following research question and hypotheses.

Research Question

Which factors within the daily practice of NPs contribute to the productive efficiency in Nurse Managed Centers?

Hypotheses

Hypothesis 1: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* based on the number of additional secondary ICD codes assigned, while controlling for Patient Residency Status, Patient Age, Patient Gender and Years of Experience for the NP.

Hypothesis 2: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for International Patient Status, while

controlling for the number of additional secondary ICD codes assigned, Patient Age, Patient Gender and Years of Experience for the NP.

Hypothesis 3: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *higher* for increasing Patient Age, while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Gender and Years of Experience for the NP.

Hypothesis 4: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *different* based on Patient Gender, while controlling for number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Years of Experience for the NP.

Hypothesis 5: In this NMC, the time for the NP to assign similar CPT codes to identical primary ICD codes will be *lower* for increasing Years of Experience of the NP while controlling for the number of additional secondary ICD codes assigned, Patient Residency Status, Patient Age, and Patient Gender.

By understanding these factors, this study is meant to provide insights into how best to operationalize and deploy limited resources of NPs, in a complex environment, such as an NMC, where a multitude of dynamics have an effect on the daily routine of NMCs and NPs.

Review of Findings

A correlation analysis showed several statistically significant relationships between the variables. Although, all of the relationships were found to be weak relationships. The results indicated that the time for the NP to assign CPT code increased

as the number of additional ICD codes increased. Whereas, the time for the NP to assign CPT code decreased as the years of experience increased. The number of additional ICD codes increased as the years of experience increased.

The results of the multivariate linear regression analyses show that no single factor was consistently significant across the entire sample population. As is theorized by CAS, many factors come together to create an environment where work is performed and while the conditions of that one environment may produce efficiency, it may not be possible for the conditions of that environment to be duplicated elsewhere and thus, be expected to produce similar efficiencies. These other environments may have their own, and different, set of factors that produce efficiency, as well, albeit via combining factors in their own novel ways.

This is not to say that there were no commonalities found within the sample population. The theory of CAS was effective in underscoring the complex commonalties and then, further, the application of the theory of RBV was effective in understanding these commonalities, thus allowing for a more efficient deployment of resources, as needed by the particular situation at hand.

Assessment of Findings

The overall results did not indicate a predictable, statistically significant and clear relationship between the variables under study. Although, in compliance with the theoretical framework of CAS and RBV, it is evident that many intricate factors played a role in developing the relationship between the variables. And furthermore, the efficient

deployment of these limited resources is dependent on the situation facing the practice setting or the larger health system.

Hypothesis 1

Hypothesis 1 stated that as the number of additional ICD codes increased, the time for the NP to assign a similar CPT code would increase, as well. Hypothesis 1 had limited support; only 1 of the 19 regression analyses was found to be statistically significant. Specifically, the analysis for the combination of CPT code 99212 (Established Patient - Level 2) and ICD code V25.49 (Surveillance of other contraceptive method). The presence of additional ICD codes increased the time for the NP to assign CPT code 99212 (Established Patient - Level 2) by 20.82 minutes.

As expected, the number of additional ICD codes was found to be statistically significant with this more complex primary diagnosis code. This diagnosis, particularly in a young adult, college age population, has a significant potential for leading to multiple secondary ICD codes of anxiety, counseling and education on further contraceptive management and sexually transmitted diseases (STD).

In the clinical setting, a primary or secondary diagnosis related to STD leads to safe sex counseling, partner treatment and lengthy counseling. In addition, if this is a first time diagnosis, providers often spend a great deal of time on reassurance, active listening and counseling around anxiety. Young adults may not have used a contraceptive method before and may require future assurance and education (Cwiak et al., 2004; Garbers et al., 2012). Furthermore, all of the participants were female students which may have led to additional time needed to educate patients on the variety of

contraceptive options available to them. Additionally, the NPs may not have used ICD code V25.8 (Other, specified contraceptive management), the discussion of multiple options is commonly associated with the V25.49 (Surveillance of other contraceptive method) code.

These findings also indicate that the NPs in this study might have under-coded for these visits. In a study by Allen and colleagues (2003) it was found that NPs, even experienced NPs, have a tendency to under code in primary care visits. In their study, 20% of the cases in an NMC were under coding the CPT code (Allen, Reinke, Pohl, Martyn, & Mclntosh, 2003). If the NPs in this study spent time during a "surveillance" visit discussing alternative contraceptive options, it would have been wise to advance the CPT code and document time for extensive counseling. Future research would need to investigate these specific visits as a substantial revenue loss could be occurring for the NMC in this study. Additionally, the NPs maybe spending time on substantial counseling which would require the addition of code modifiers for teaching and counseling services by time spent and thus, provide higher reimbursement for the practice (Sullivan-Marx et al., 2000).

Lastly, as indicated by the post-hoc comparison using Fisher's LSD analysis for ICD code 626.4 (Irregular menstrual cycle), where it was statistically different from 10 of the 15 ICD codes analyzed, it was expected that this code would show some interaction with other similarly complex codes, for example V25.49 (Surveillance of other contraceptive method). Unfortunately, such an analysis could not be conducted because the small sample size for this ICD code did not meet the threshold requirements for

inclusion in the multivariate linear regression analysis for this study. This is an area of opportunity for further research.

Hypothesis 2

Hypothesis 2 stated that international student status would increase the time for the NP to assign a similar CPT code. Hypothesis 2 was not supported. This outcome may reflect the fact that nearly 73% of the patients identified themselves as domestic students in the sample. The regression analysis with the combination of CPT code 99214 (Established Patient - Level 4) and ICD code 616.10 (Vaginitis and vulvovaginitis, unspecified) was close to significance for international student status ($p = 0.06$) and the number of additional ICD codes ($p = 0.06$). Lastly, the post hoc analysis indicated that ICD 616.10 (Vaginitis and vulvovaginitis, unspecified) was statistically significant from related ICD codes. For example, 626.4 (Irregular menstrual cycle), V25.01 (General counseling on prescription of oral contraceptives) and V25.49 (Surveillance of other contraceptive method). A larger sample size of international students may provide additional insights into testing this hypothesis.

Hypothesis 3

Hypothesis 3 stated that with increasing patient age the time for the NP to assign a similar CPT code would increase, as well. Hypothesis 3 was not supported. This outcome may reflect the fact that the data for this sample came from a NMC serving mostly college age students with a mean age of 23.57 years and with a SD of 5.16. While not statistically significant, the regression analysis for CPT code 99214 and ICD code

V25.01 (General counseling on prescription of oral contraceptives) was close to significance for age ($p = 0.09$). This, potentially, indicates that age may have an effect in the setting for this study. Moreover, ICD code V25.01 (General counseling on prescription of oral contraceptives) has the potential for using additional time for reasons similar to the findings of hypothesis 1. A larger sample size with a greater range of ages may provide additional insight into testing this hypothesis.

Hypothesis 4

Hypothesis 4 stated that the time for the NP to assign a similar CPT code would differ by the gender of the patient. Hypothesis 4 had limited support; only 1 of the 19 regression analyses was found to be statistically significant. Specifically, the analysis for the combination of CPT code 99203 (New Patient - Level 3) and ICD code 477.9 (Allergic rhinitis, cause unspecified). The time for NP to assign CPT code 99203 (New Patient - Level 3) took 14.73 fewer minutes for females than males.

The statistically significant difference for ICD code 477.9 (Allergic rhinitis, cause unspecified) was also evident in the post-hoc comparison using Fisher's LSD analysis. The analysis revealed that ICD code 477.9 (Allergic rhinitis, cause unspecified) was statistically significant from 10 of the 15 ICD codes analyzed and took the second greatest time for NP to assign code at 53.88 minutes ($SD = 25.79$).

Allergies are generally difficult to diagnose and can manifest themselves as potential symptoms of other causes requiring a substantial differential diagnosis time, particularly for a new patient visit, as it was in this case. Literature also suggests that gender concordance (female providers and female patients) may increase patient

education and counseling (Bertakis & Azari, 2007; J. Hall & Roter, 1994). In a study, lasting one year and reviewing both initial and subsequent visits, it was reported that female patients and female providers, more so than male patients and male providers, display attributes of gender concordance (Bertakis & Azari, 2007).

Another study discovered that after controlling for visits and patient characteristics, visits by women had a higher percentage of time spent for counseling, physical examinations, patient questions and screening, concluding that outpatient visits for women differ than outpatient visits for men (Tabenkin, Goodwin, Zyzanski, Stange, & Medalie, 2004). However, given that this was only significant for one regression analysis, a larger sample may support this explanation.

Furthermore, while not statistically significant, years of experience for the NP was close to statistically significant ($p = 0.07$) for the regression analysis for CPT code 99214 (Established Patient - Level 4) and the ICD code 477.9 (Allergic rhinitis, cause unspecified). Thus, the time for the NP to assign CPT code 99214 (Established Patient - Level 4) was 1.80 minutes less for experienced NPs. This finding suggests that, perhaps, a larger sample size would provide more information in supporting the assessment that less time is needed by more experienced providers in diagnosing allergies (even for new patients).

Hypothesis 5

Hypothesis 5 stated that with increasing years of NP experience the time for the NP to assign a similar CPT code will decrease, as well. Hypothesis 5 had limited

support, but more than all of the other hypotheses; 2 of the 19 regression analyses were found to be statistically significant. Specifically, the analysis for the combination of:

1. CPT code 99214 (Established Patient - Level 4) and ICD code 462 (Acute pharyngitis) and
2. CPT code 99214 (Established Patient - Level 4) and ICD code V25.01 (General counseling on prescription of oral contraceptives).

1) The time for the NP to assign CPT code 99214 (Established Patient - Level 4) and ICD code 462 (Acute pharyngitis) decreased by 1.22 minutes for every one year increase in year of experience for the NP. In a young adult population, sifting through the process of 11 different differential diagnoses for acute pharyngitis can be a challenge (Epocrates Online, 2015). Additionally, the age of the patient also makes these diagnoses difficult as the patients could still be considered teenagers/children which complicates the decision-making process. Upon further review of the data, it was discovered that when evaluating only the most experienced providers for this sample, the mean time for the NP to assign CPT code 99214 (Established Patient - Level 4) reduced to 35.22 minutes (SD = 13.51). Whereas, when assessing only the least experienced provider, the mean time for the NP to assign CPT code 99214 (Established Patient - Level 4) was 52.37 minutes (SD = 16.30). Thus, it took the newest provider an average of 22 minutes longer to complete the cognitive work a differential diagnosis for ICD code 462 (Acute pharyngitis). With experience, primary care providers learn the difference in presentation and symptoms and can more quickly decipher the differential diagnosis process.

2) The time for the NP to assign CPT code 99214 (Established Patient - Level 4) and ICD code V25.01 (General counseling on prescription of oral contraceptives) decreased by 1.86 minutes for every one year increase in year of experience for the NP. Similar to Hypothesis 1, this diagnosis, particularly in a young adult, college age population, has a significant potential for substantial education, as well as, discussions of safe sex counseling, partner discussions and lengthy counseling. In addition, if this is a first time use of contraception, providers often spend a great deal of time on reassurance and active listening. While, with increasing experience, a provider gains sufficient knowledge of the counseling needs for oral contraception; she or he may have fewer reasons to consult online or text book resources to determine the best oral contraception choice among the myriad of options (R. Hatcher, Trussell, & Stewart, 1995; Robert Anthony Hatcher, 1997; Robert A Hatcher & Kowal, 1990) to determine the most important educational items (Center for Young Women's Health, 2015) and ensure safe and high quality care (Gundersen Health System - Options Clinic, 2015).

Recommendations for Management Practice

This study indicated that a clinical practice setting or a larger health system has to look at many factors if it intends to operationalize productive efficiency. For example, if an NMC is serving patients that tend to have multiple ICD codes, it might be best to allocate its most experienced NP, to this population. To use limited resources more efficiently, a NP with limited experience should be allocated to new patients or established patients with expected low complexity ICD codes. Additionally, it may suit the system to allocate resources based on the prior history of usage of time by the

provider. This limitation on the allocation of resources, where novice providers are given low complexity cases, would have to be balanced with the addition of complex cases over time to the NPs patient mix. This would provide valuable experience to the novice NP, while simultaneously offering the system the use of a resource to the maximum efficiency and developing a resource that can be more fully allocated in the future.

Sullivan-Marx, et al (2000), in their landmark study of content and RVU for NPs determined that "capturing the moment" was crucial in determining the work component of a NP (Sullivan-Marx et al., 2000). A participant in their study is quoted as saying, "Once the client is in the office, it is difficult for me to lose that moment of teaching prevention" or "In my high-risk population, I would need to do the Pap smear – because she would possibly not come again – and other health prevention activities, as well as evaluate the presenting complaint". Leaders of NMCs should consider delegating tasks that are not part of the billable portions of the patient visit to Registered Nurses (RN) or Certified Medical Assistants (CMA). As an added benefit, this would allow the other providers of health care to practice to the fullest extent of their training as recommended by the IOM in *The Future of Nursing; Leading Change, Advancing Health* (Institute of Medicine, 2010). The delegation of work would also allow the NMC to reallocate its higher trained resources to activities most suited to their skill set.

Additionally, the documentation of the care provided during a visit should be audited frequently. The frequency of auditing documentation for continuous quality improvement should be high for new NPs, but should also be conducted regularly for the more experienced NPs, as regulations defining documentation requirements change often (Allen et al., 2003). This is particularly true in light of the approaching ICD 10

implementation. For example, the lack of past medical, social or family history in the documentation could easily render a CPT code 99214 (Established Patient - Level 4) visit to a CPT code 99213 (Established Patient - Level 3) visit (Buppert, 2002; Frakes & Evans, 2005).

Considering the general characteristics of the age group of this study - young, mobile and technology friendly – NMCs should also consider telemedicine services or other virtual visits to maximize productive efficiency. In a 2004 survey by Cotton and Gupta, they discovered that income, age and education were found to be the predictor variables for the usage of digital mediums (Cotten & Gupta, 2004). Even though, the current reimbursement mechanism from Medicare for telemedicine services is limited and confusing, telemedicine visits have been increasing in demand, capability and acceptability (Frakes & Evans, 2005).

Recommendations for Policy Makers

For policy makers, this and the other studies referenced in this paper, indicate that additional time is being spent by NPs on activities that assist with health promotion and health care counseling and thus, have a potential to reduce future health care costs. As noted previously, the number of additional secondary ICD codes was a statistically significant indicator of additional time being spent by the NP. This was true for complex ICD codes indicating that counseling and education might be the cause of this extra time. If, it is accepted that there is a social component to health (Institute of Medicine, 2001) and NPs provide this care then, it will take extra time to provide this care. Even though CPT codes exist for preventative E&M visits, counseling and guidance to reduce risk,

these CPT codes are not reimbursed (Sullivan-Marx et al., 2000). The benefits of this extra time spent and work being done today, could be seen in better health behaviors and appropriate utilization of health care resources in the future. The already established practice patterns of NPs, which support review of social determinants of health, should be encouraged by allowing for equal parity with physician fee schedule.

Since Medicare reimbursement policies are often used as a proxy by commercial payers to alter their reimbursement policies, it is appropriate for Medicare to lead the way in financially supporting the holistic visits by NPs that motivate behavioral changes in patients, particularly young patients, which may lead to cost savings in the long run.

Additionally, CPT codes for evaluation and management services (99201 through 99205 and 99211 through 99215) are not sufficient to capture the wide variety of activities and work performed in an office visit. For example, while there are 15 different and detailed CPT codes for knee surgery, a single E&M CPT code of 99213 (Established Patient - Level 3) is expected to capture the complexities of an office visit that can range from a simple physical examination to follow-up visits for co-morbidities of diabetes that can include; hypertension, sleep apnea, obesity, etc., and their necessary education and counseling (Johnson & Newton, 2002).

Similarly, since RVUs do not account for the experience of the provider, only the work performed, RVUs should be adjusted to reflect experience. RVUs are already adjusted for a number of factors, e.g., geographic location, expense, etc., and hence, further adjusting RVUs to reflect experience should be possible (Rhoads, Ferguson, & Langford, 2006). Moreover, this adjustment is being extended to include measures of

quality outcomes, patient satisfaction or other results expected from more experienced providers.

Recently, Michigan was awarded $70 million in federal funding to pursue innovations in multi-payer payment systems and pilot projects in transformation of health care delivery systems. The model will include: patient and family-centered health homes; coordination and accountability of the medical neighborhoods; integration among health care and community resources and approaches to incorporating safe and healthy communities, workplaces and lifestyles (Michigan Department of Health and Human Services, 2015).

With the increased focus on new payment and care systems, which rely on ever increasing participation by all types of health care providers and practice sites for success - an equitable reimbursement policy would foster increased participation from smaller and independent NMCs and NPs.

Limitations of the Study

This study was conducted from data gained at one NMC, in one state, with highly restrictive SOP laws. Therefore, the findings of this study are limited to this setting. However, this does not limit the generalizability of the study design to other NPs and NMCs. Further studies in other NMCs and in other states with varying scope-of-practice regulations, would mitigate this limitation. In addition, this NMC had a limited number of NPs and thus, contributed repeated observations to the data. More sophisticated data modeling strategies that account for these repeated observations may be employed to more appropriately investigate the hypotheses. However, such modeling advantages are

a plan for future research. The limited number of NPs was also evident in the variable that measured years of experience for the NP. These limitations can be overcome by extending the study to NMCs that have a larger number of NPs with a varying number of years of experience.

Another limitation of this study is the characteristics of the sample population. This NMC provides primary health care services, largely, to 18-26 year old individuals. While this characteristic was important to this study since, this age group plays a significant role in the debates on health care access and rates of health care utilization; the generalizability is limited to this age group. Though, this limitation can be advantageous to NMCs or other health care organizations that focus their services to this age group. Furthermore, the preponderance of this age group in the sample implies that a limited variety of ICD codes are present in the sample.

A small sample size also contributed to the limitations of this study. Although, there were 827 cases in the complete sample, analyses were conducted with as few as 15 cases. It is assumed that a study with larger sample size might have a better representation in the variety of patients, ICD codes, CPT codes and NPs with a greater diversity of practice experience.

Recommendations for Future Research

Future research should be directed towards larger samples, longer time frames in collecting data and a greater variety of variables. For example, collecting additional variables that provide data on the cultural background of the students, knowledge of the US health care system, frequency and number of follow-up visits and more. The addition

of new variables is supported by the CAS theory as these variables would shed further light on the application of RBV to NMCs and NPs. Furthermore, the variables could be interacted in novel ways in different or, even, similar environments. For example, an interaction between patient residency status and experience with the US health care system; patient gender, patient residency status and gender concordance; the utilization rate of health care services and availability of tele-health visits and more.

Another opportunity for future research is to look at more than time as a measure of productive efficiency as the outcome variable, which was the focus of this study. The study on efficient deployment of providers could be extended to include the effects of: the background, training and experience of the NPs; origin of the international students; cultural and language preferences; prior health history; current or prior utilization of the health system; current or prior experience with the US or other health system; insured status; interactions with and preferences for; preventative, educational and counseling services vs. interventional services and the numerous ancillary services that can be a part of routine examinations, for example, pharmacy, rehabilitation services, diagnostics, etc.

Similarly, this study only reviewed the number of additional ICD codes in aggregate and their effect on the use of time. The additional ICD codes could be studied to see if a relationship exists between the primary ICD code and any additional ICD codes and their effect on time or other outcome variables. For example, ICD codes 616.10 (Vaginitis and vulvovaginitis, unspecified), V25.01 (General counseling on prescription of oral contraceptives) and V25.09 (Other general counseling and advice on contraceptive management) were close to statistically significant for age, patient residency status, number of additional ICD codes and years of experience for the NP.

While, the review of time can be used to better allocate NP resources, its effect can be far reaching. It could be argued that, if NPs are using more time, is this affecting the rate of current patient access (front office cannot schedule more patients) or patient satisfaction (patients are dissatisfied because it takes too long to see the provider or patients are satisfied with the time and thus, require fewer visits and in parallel, providing increased access for other patients without increasing staffing needs) or the work of other downstream ancillary providers (the laboratory or x-ray departments have to stay open longer to accommodate the extra time spent by NPs or vice-versa).

Additionally, long term and follow up studies could be performed on returning patients, particularly in cases where the number of additional ICD codes had a significant effect, to study if time became less of a constraint as patients became more knowledgeable about their health and how the education and counseling sessions were having their intended effect. Lastly, this study and its model could be extended to review the productive efficiency of Registered Nurses, Physician Assistants (PA), Therapists and other health care providers. Further research could be conducted in environments where NPs work as hospitalists, medical director of nursing homes, urgent care centers and are the "on duty" provider in rural emergency departments (ED).

In rural areas, the ED is usually staffed with an NP. The NP is expected to provide care to the fullest extent of their training, until, and if, a collaborative hand-off to the physician is needed. As noted before, 18% of the NPs practice in rural or frontier settings (American Association of Nurse Practitioners, 2014). There is existing research in EDs showing evidence of accessibility, equal care to physicians, no increase in staffing needs and patient satisfaction (Burgess, 1992; Chang et al., 1999)

Such a model brings us full circle to 1965, when the first NP training program was implemented as a source of collaboration and cooperation with physicians in pursuit of providing care and value to the patient.

Summary

This study applied quantitative methods to research the productive efficiency of NPs within the context of CAS and RBV theories. The findings add to the growing literature on the benefits of using NPs within the health care system, the complexity of the work of nursing and NPs and provide a model to further research the productive efficiency of NPs in practice locations other than NMCs.

The productivity of NPs – or any other provider - is a critical component of increasing patient access in health care. Health care is an environment that is facing limited resources across the continuum. One such limited resource is the pool of providers and the health care industry is not likely to solve the problem of increasing access, by simply increasing the number of providers. This study sought to find one way of determining the most efficient allocation of these providers. As mentioned previously, and indicated by CAS and RBV, there are many factors that go into determining what is efficient. Once that has been clarified, one has the tools to determine how best to operationalize that efficiency. The question in front of us now is: how many ways are there to be efficient and can we find evidence of that efficiency? And then, the most important part, can we implement that efficiency?

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APPENDIX A

UAB INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

DATE: 12/18/14

MEMORANDUM

TO: Faraz Ahmed
Principal Investigator

FROM: Cari Oliver, CIP
Assistant Director
Institutional Review Board for Human Use (IRB)

RE: Request for Determination—Human Subjects Research
IRB Protocol #N141203003 – Evaluation of the Productive Efficiency of Nurse Practitioners in a Nurse managed Center in a Highly Restrictive Scope-of-Practice State

A member of the Office of the IRB has reviewed your Application for Not Human Subjects Research Designation for above referenced proposal.

The reviewer has determined that this proposal is **not** subject to FDA regulations and is **not** Human Subjects Research. Note that any changes to the project should be resubmitted to the Office of the IRB for determination.

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Alabama at Birmingham
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BIRMINGHAM AL 35294-0104

APPENDIX B

WSU INSTITUTIONAL REVIEW BOARD APPROVAL

WAYNE STATE UNIVERSITY

IRB Administration Office
87 East Canfield, Second Floor
Detroit, Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
http://irb.wayne.edu

CONCURRENCE OF EXEMPTION

To: Faraz Ahmed
College of Nursing

From: Dr. Deborah Ellis
for Chairperson, Behavioral Institutional Review Board (B3)

Date: January 07, 2015

RE: IRB #: 122014B3X

Protocol Title: Evaluation of the Productive Efficiency of Nurse Practitioners in a Nurse Managed Center in a Highly Restrictive Scope-of-Practice State

Sponsor:

Protocol #: 1412013631

The above-referenced protocol has been reviewed and found to qualify for **Exemption** according to paragraph #4 of the Department of Health and Human Services Code of Federal Regulations [45 CFR 46.101(b)].

- Social/Behavioral/Education Exempt Protocol Summary Form (received in the IRB Office 12/2/2014)
- Protocol (received in the IRB Office 12/2/2014)
- HIPAA Summary Form (received in the IRB Office 12/2/2014)
- A waiver of HIPAA Authorization has been granted in accordance with the Privacy Rule and justification provided by the Principal Investigator in the HIPAA Summary Form. This waiver satisfies: 1) the use or disclosure of PHI involves no more than minimal risk to the privacy of individuals, 2) the research could not be practicably conducted without the waiver, 3) the research could not be practicably conducted without access and use of the PHI, 4) adequate steps taken to protect identifiers from improper use or disclosure and 5) adequate plan for destroying identifiers or links.

This proposal has not been evaluated for scientific merit, except to weigh the risk to the human subjects in relation to the potential benefits.

- Exempt protocols do not require annual review by the IRB.
- All changes or amendments to the above-referenced protocol require review and approval by the IRB **BEFORE** implementation.
- Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the IRB Administration Office Policy (http://irb.wayne.edu/policies-human-research.php).

NOTE: Forms should be downloaded from the IRB Administration Office website http://irb.wayne.edu at each use.

APPENDIX C

PERMISSION TO USE FIGURE 1

Faraz S Ahmed

From: Linda Pearson [redacted]
Sent: Thursday, May 07, 2015 11:36 AM
To: Faraz S Ahmed
Subject: Requesting Permission to Use NP Scope of Practice Image

Importance: High

Thank you for your patience and I apologize for the delayed response to your inquiry. The 2014 Pearson Report is available:

You can access the report at http://nursing.jbpub.com/pearsonreport/.

You can also view the catalogue page for the Report at http://go.jblearning.com/PearsonReport

You can obtain permission for the most updated Pearson Report from this publisher. I do not own the copyright of this one.

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Dr Linda Pearson DNSc APRN,BC

From: Faraz S Ahmed [redacted]
Sent: Sunday, May 03, 2015 10:09 PM
To: [redacted]
Subject: Requesting Permission to Use NP Scope of Practice Image

Hello Ms. Pearson,

My name is Faraz Ahmed. I am an Executive Doctoral student in Health Services Administration at The University of Alabama at Birmingham.

During the research for my dissertation, I came across the work you do in compiling and summarizing scope-of-practice laws for NPs.

In your 2012 report, you used a map of the US depicting scope-of-practice rights for NPs

I am writing to request permission to use that image.

I look forward to hearing from you.

Thanks,
Faraz

1

APPENDIX D

PERMISSION TO USE FIGURE 2

Faraz S Ahmed

From: Matthew Mariani [redacted]
Sent: Monday, May 18, 2015 1:18 PM
To: Faraz S Ahmed
Subject: FW: Request for Permission to Use Image

Hello Faraz,

You are welcome to use the graphic. We only request that you give attribution to the National Quality Forum.

Matthew Mariani
Production Manager | National Quality Forum
1030 15th Street NW, Suite 800 | Washington, DC 20005 | 202-559-9522
NQF Quick-Reference Style Guide
Key Point Sheet for preparing report documents
Link to training resources

From: Faraz S Ahmed [redacted]
Sent: Sunday, May 03, 2015 11:57 PM
To: efficiency
Subject: Request for Permission to Use Image

Hello Quintin,

My name is Faraz Ahmed. I am an Executive Doctoral student in Health Services Administration at The University of Alabama at Birmingham.

During my research for my dissertation, I came across some of the work done listed on the following site:

http://www.qualityforum.org/ProjectDescription.aspx?projectID=72221

There is a figure in the middle of the above URL, that I would like to use in my dissertation.

I am writing to request permission to use that image.

I look forward to hearing from you.

Thanks,
Faraz

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