1-1-2017

Cost of Physical Therapists Serving as a Musculoskeletal Providers Compared to Family Practice Providers in a Military Treatment Facility

Troy Edward McGill
Nova Southeastern University

Cost of Physical Therapists Serving as a Musculoskeletal Providers Compared to Family Practice Providers in a Military Treatment Facility.

By

Troy E. McGill

A Dissertation Presented to the College of Health Care Sciences for partial fulfillment of the requirements for the degree of Doctor of Philosophy in Physical Therapy

Nova Southeastern University

2017

Abstract

Background. Physical therapists (PTs) in the U.S. military practice direct access and can order limited prescription medications, imaging studies. Military PTs function as autonomous primary care managers (PCMs) for patients with musculoskeletal (MSK) disorders.

Objective. The study compared cost of PT management of patients with MSK disorders to management by traditional PCMs; medical doctors (MDs), doctors of osteopathic medicine (DOs), advanced registered nurse practitioners (ARNPs), and physician assistants (PAs).

Methods. The researcher used a retrospective study of electronic medical records, using an exploratory, non-experimental, cross-sectional, and quantitative design method.

Results. At an Air Force military medical clinic during an 18-month period from January 2016 through June 2017, 8,053 patients with MSK disorders were assessed. PT management of MSK patients resulted in a significantly lower rate of imaging studies, NSAIDS and cost of care when compared to MDs, DOs, PAs, or ARNPs. Patients with MSK disorders managed by PTs had no significant difference in return to work rate when compared to MDs, DOs, PAs, or ARNPs.

Limitations. Data was collected at one Air Force medical clinic, with the majority of patients being active duty military.

Conclusions. Findings suggest that PTs returned patients to work on par with care provided by traditional PCM's. However, PTs used significantly fewer medications and imaging studies resulting in less overall cost of care. Longitudinal studies looking at recurrence rate of MSK conditions comparing non-PT PCMs to traditional PCMs manage would be of value when assessing cost over time.

Keywords: Direct access physical therapy, primary care physical therapy.

Approval Page

Table of Contents

List of Tables

List of Figures

Chapter 1: Problem Statement and Goal

Over the course of a century, physical therapy (PT) has advanced along a continuum of increased responsibility from a physician-directed, prescriptive occupation to a profession where autonomous practice is common. The independent practice model continues to evolve as PTs petition legislative members to approve laws that allow full autonomous practice.[1]

Department of Defense (DoD) and civilian PTs who practice in a military treatment facility (MTF) are covered under federal law that grants practice privileges, which include the ability to order diagnostic imaging and laboratory studies, prescribe certain medications, perform joint injections, and restrict work-related activities.[2] Physical therapists who practice in the DoD must meet certain educational criteria to earn independent practice privileges.[3] Graduates of U.S. Doctor of Physical Therapy (DPT) programs, other than the Army-Baylor DPT program, may lack residency or clinical internship training that allow them to write prescriptions, order imaging studies and lab tests. As a result, completion of the U.S. (USAF) advanced PT course is mandatory for direct access privileges as well as for receiving deployment clearance for PTs who did not enter the USAF from the Army-Baylor DPT program. The 10-day USAF advanced PT course and the Col. Doug Kersey advanced clinical and operational practice course focus on differential diagnostic methods, and on basics of pharmacology, radiology, and laboratory tests and measures to help determine specific diagnosis. Case reports and deployment scenarios serve as learning modules. Basic suturing, joint injections, dry needling, in-field joint and bone reduction, and basics of casting are taught and practiced. Either of these courses gives DoD PTs the clinical practice classification of advanced PT practitioners.[2,3] A physician preceptor is required to serve as a mentor for the first year of an advanced PT practitioner's practice. The

physician preceptor reviews a select number of cases and discussed the cases with the PT if there are standard of practice issues.

Currently, only PTs who practice in the DoD are eligible to have these practice privileges. DoD PTs can be active duty military members, civil service employees, or contract PTs. These practice credentials permit DoD PTs to serve as health care entry-point providers. Only active duty PTs deploy in support of military operations.

Current U.S. DPT programs provide the didactic preparation sufficient for independent practice, but do not provide specific instruction or practice for to writing prescriptions and ordering laboratory and imaging studies.[3,4] Even so, many DPT programs list as a goal the preparation of students to practice independently as primary care neuro-musculoskeletal providers.[3,5] As the profession transitioned from the entry-level requirements of a bachelor's degree to a doctoral degree, the core content of all PT programs increased to provide foundational material to train PTs as independent providers. As the profession began to regard the doctoral level as the standard, entry-level degree, many PTs who graduated at the masters level needed to increase their clinical knowledge, a need that led to the formation of transitional DPT (tDPT) programs. The tDPT programs contain courses that focus on: clinical decision-making; diagnosis and medical screening; diagnostic imaging; pharmacology; health care systems; business and economics; outcomes measurement; patient/client management; clinical research; principles of evidenced-based practice; content specific to the MSK, neuromuscular, cardiovascular-pulmonary, and integumentary systems; health promotion and wellness; professionalism and professional issues; and applied, case-based analysis or capstone.[3] Although PTs in the United States have the education and medical skills necessary to practice

independently, only PTs in the U.S. military are allowed to practice as independent providers who are not required to have traditional PCM oversight.

Family practitioners, general internists, and pediatric physicians traditionally provided primary care medicine in the United States, but over the last 20 years, physician extenders, PAs, and ARNP have been included as PCMs. PAs are required by law to work under the supervision of a physician. Some states allow ARNPs to work independently without physician oversight, but with some limitations on practice. These non-physician PCMs have helped ease the access-to-care burden the U.S. health care system is experiencing due to a significant shortage of physician PCMs. Even with these additional providers, however, there continues to be a significant shortage of PCMs. The Institute of Medicine (IOM) predicts that the shortage of U.S. PCMs will likely worsen.[6,7] The IOM reports that an additional 16,261 PCMs are needed to meet the current demand for U.S. primary healthcare services.[8] Because of several advances in PT education, training, and practice capabilities, coupled with legislative changes, PTs are proving themselves to be safe, effective, direct access providers. PTs offer a viable solution for substantially improving access to care for a certain well-defined population.[3,9,10,11,12] A growing segment of health care professionals and the public view also PTs as experts for non-operative care of MSK injuries and movement disorders.[13]

All 50 states currently allow some form of PT direct access.[15] The Commission on Accreditation in Physical Therapy Education (CAPTE) accredits all 227 U.S. academic institutions that offer PT education, now requiring a DPT degree to graduate.[15] Doctoral PT programs are required to contain course work that provides skill sets such as differential diagnosis, radiology, understanding laboratory tests, and pharmacology.[16,17] Students who attend the Army-Baylor DPT program are the only students exposed to the application of these acquired

skill sets, and then only if the students' clinical rotations occur at a DoD medical treatment facility. Unfortunately, most civilian DPT clinical internships do not allow or include the ability to gain experience ordering imaging and laboratory tests, prescribing medication or making referrals to other medical practitioners due to restrictive state PT practice legislation and regulation. For changes to occur that would allow PTs to use their full educational skill set, state PT practice rules must support increases in scope of practice privileges for the profession, and payers must ensure that PTs are compensated for services when seeing patients without referral.

The increased educational standards that prepare PTs for autonomous practice, coupled with the inability of PTs to use autonomous practice skills, are primary reasons that the American Physical Therapy Association (APTA) is pushing lawmakers to make legislative changes.[18] There are multiple studies that support the APTA's position that PTs are educationally qualified and safe to see patients without a referral.[10,14,19,20] PTs are trained to screen all patients for appropriateness of care, and are able to identify when patients need referral to other providers. Similarly, the law requires PTs to refer patients who present with conditions that are beyond their particular scope of practice. This determination to refer depends solely on the PTs clinical judgment and differential diagnostic expertise.

Fully autonomous PT practice involves much more than the ability to evaluate and treat patients without a referral. Clinical privileges necessary for unrestricted direct access PT must mirror those of other non-physician providers who see patients without a referral, such as ARNPs and PAs. These providers are privileged to order imaging studies, medication, laboratory tests, and to serve as a patient's PCM. Until DPT students can practice these skill sets taught in DPT programs, some transitional education specifically oriented to indications and guidelines regarding how to appropriately order and select the correct medications, imaging studies, and

laboratory tests is warranted. This transition program could be offered in a similar manner as the tDPT program that helped to fill the gap for PTs who graduated without the doctoral degree.

There are benefits to direct access PT other than just increasing access to care for certain patients. Researchers have shown that direct access PT may help control or decrease overall health care costs.[10,21,22,23] A PT in a deployed military location demonstrated cost control through decreased recovery time and lost days from work.[21] Using PTs as PCMs is consistent with the APTA's vision statement:

> By the year 2020, physical therapy services will be provided by physical therapists who are Doctors of Physical Therapy and who may be board-certified specialists. Consumers will have direct access to physical therapists in all environments for patient/client management, prevention, and wellness. Physical therapists will be practitioners of choice in patients'/clients' health networks and will hold all privileges of autonomous practice.[18]

The language of the APTA regarding direct access was modified to note that the goal is to have PTs as a point of entry into the health care system.[1]

PT scope of practice standards are set by individual state practice acts.[4] Direct access in states with even the most liberal classification of PT services currently allows only evaluation and treatment without the ability to order medication, certain imaging studies, or laboratory tests as shown in Figure 1.[24]

Figure 1. Levels of Patient Access to PT Services in the United States

Limited patient access (6 states)

(Access to evaluation, fitness & wellness, and limited treatment only to certain patient populations or under certain circumstances (i.e. treatment restricted to patients with a previous medical diagnosis or subject of a previous physician referral).)

Alabama, Missouri, Illinois, Texas, Mississippi, and Wyoming.

Patient access with provisions (26 states, Washington, D.C. and the U.S. Virgin Islands)

(Access to evaluation and treatment with some provisions such as a time or visit limit, or referral requirement for a specific treatment intervention such as needle EMG or spinal manipulation.)

Arkansas, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Indiana, Kansas, Louisiana, Maine, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, Washington, and Wisconsin.

Unrestricted Patient Access (18 states)

(No restrictions or limitations whatsoever for treatment absent a referral.)

Alaska, Arizona, Colorado, Hawaii, Idaho, Iowa, Kentucky, Maryland, Massachusetts, Montana, Nebraska, Nevada, North Dakota, Oregon, South Dakota, Utah Vermont, and West Virginia.

Multiple studies support the efficacy and prudent use of PT orders for radiology or laboratory studies.[25,26] Such studies demonstrate the ability of PTs to perform a differential diagnosis to determine if a patient presentation warrants imaging or other studies to clarify the patient's condition.[21,26] For example, Garber[26] presented a case report of a patient who had visited a family practice physician, who then referred him to a PT. Based on this physician's differential and clinical diagnostic skills, the practitioner did not order any imaging studies. The patient was an active duty military paratrooper who sustained cervical spine trauma from a hard parachute landing. As noted, he was seen and evaluated by a family practice physician for complaints consistent with a C6 radiculopathy. The patient was cleared by the family practice physician and referred to PT for evaluation and treatment. Based on the patient's physical examination, the PT ordered cervical-spine imaging, which revealed a possible fracture. The PT

referred the patient to orthopedics, where a magnetic resonance imaging (MRI) was ordered, revealing a C5 displaced vertebral body fracture. The patient underwent emergency C5-6 fusion.[26] Orthopedic evidence has also demonstrated increased safety and effectiveness of PTs as the provider of choice.[21] This study (N=126) demonstrated that PTs provided a 50% greater RTW rate than family practice physicians. The rate of medication and imaging use for PTs was 24% and 11% respectively, whereas the PCM's medication and imaging usage rate was 90% and 82%, respectively ($p < 0.01$). Direct access PT in this military practice setting suggested that direct access PT could be an effective and efficient practice model.[21]

Autonomous PT practice within the DoD is defined as: a PT who is credentialed by the DoD to operate without physician referral like other non-physician providers such as podiatrists, ARNPs, and PAs.[19,27] These practice rights allow DoD PTs to function as PCMs for patients with MSK complaints. Overall, the military practice model is unique – only a very small subset of PTs in the United States are credentialed by the DoD to function as a direct access provider with independent practice privileges. MTFs contain PT outpatient clinics where PTs see active duty military personnel as well as military dependents, retirees, spouses of retirees, and Veteran's Administration patients. This patient mix includes a diverse caseload of patients with MSK disorders that closely mirror the civilian population.[28]

Most PCMs often have limited knowledge of the management of MSK conditions and little, if any, exposure to the practice and capabilities of PT. Nonetheless, these providers are expected to give specific instructions or orders on what patients receive when they refer for PT services.[29,30] This practice model is analogous to a PCM referring a patient to a specialist and ordering the specialist to perform a certain procedure. When a PCM refers to a specialist –to an orthopedic surgeon, for example – that medical practitioner is considered the expert and as such

does not receive an order for care by the referring PCM, but is consulted. The PCM understands that he/she does not have the skills equivalent to the specialist and as such defers all decisions involving patient care to that specific medical provider. Military PTs are consulted to provide the care that they deem most appropriate based on their clinical assessment. Many MTFs do not have orthopedic providers or neurosurgeons on staff. If a service member requires care from a provider who is not on the MTF staff, they will be referred to the local community providers. PTs who practice in DoD receive referral PT prescriptions from these off-base specialty providers. Because the culture has not shifted sufficiently, off-base, civilian, non-PT PCM providers typically do not view PTs as expert MSK referral sources, but instead view them as a technician who will follow their specific orders. Despite this currently accepted perception of PT care, multiple studies examining levels of MSK knowledge of both family practice providers and medical residents have identified a lack of competency in the evaluation of patients with MSK complaints.[31,32] Based on this evidence, it could be argued that the physicians who function as PCMs, not to mention PAs and ARNPs, should have limited (if any) influence on the evaluation and treatment offered by a PT.[31,32,33,34] The studies reinforce the idea that in regards to MSK training for PCMs, "more emphases are placed on education in possible surgical or medication management than in non-operative care of MSK conditions", which has been noted as a major cause of unnecessary health care expenditures. [32,33,34] Non-operative care of MSK complaints is not an area that most PCMs are experts; however, as noted, PTs are the MSK non-operative care experts and in an attempt to control cost and provide patients with appropriate care, a major cultural shift away from the PCM gate keeper model needs to occur within our health care environment.[35]

Even though PT direct access is legal in all 50 states, payers often require a referral from a PCM or physician in order for PT reimbursement to occur. This process has improved in recent years and now PTs can bill some third-party payers without a PCM's referral to receive payment for services.[36] The extra step of requiring patients needing a referral to see a PT often increases health care costs and wait time for patients to receive care. Researchers showed that the practice model that requires patients to obtain a referral to see a PT from a PCM (who functions as a gatekeeper) is wasteful and inefficient, supporting the value of direct access to PT.[20,37,87]

This study was designed to examine issues of PT cost for patients with MSK complaints when a PT PCM or a non-PT PCM manages patient care. The study collected collect data from multiple military treatment facilities MDs, DOs, PAs, ARNPs, or PTs serve as PCMs for all patients.

Operational Definition

This study examined the cost of care from a provider's perspective as it relates to medical management for patients with MSK disorders. Cost will be measured as follows:

1. total cost associated with care, including all evaluations and treatment services, medication and diagnostic tests;
2. number of clinic visits required before return to work (RTW)

Research Question

Do PTs acting in the role of PCMs for patients with MSK disorders demonstrate a significant difference in overall cost of care to include: (a) imaging use; (b) medication use; (c) RTW rates; and (d) number of visits compared to patients with MSK disorders who are managed by MDs, DOs, PAs, or ARNPs acting as PCM?

Aim 1: Between-group differences were assessed for patients with MSK disorders regarding imaging use. Do PTs acting in the role of PCMs for patients with MSK disorders demonstrate a significant difference in the overall cost of care with imaging use compared to patients with MSK disorders who are managed by MDs, DOs, PAs, or ARNPs acting as PCMs? The number of imaging studies ordered and the cost is based on the national average for a three-view knee study at $179.00, three-view shoulder study at $200.00, and three-view lumbar spine study at $349.00.[39]

Aim 2: Between-group differences were assessed for patients with MSK disorders regarding medication use. Do PTs acting in the role of PCMs for patients with MSK disorders demonstrate a significant difference in the overall cost of care to include medication use compared to patients with MSK complaints who are managed by MDs, DOs, PAs, or ARNPs acting as PCMs? The number of prescriptions for nonsteroidal anti-inflammatory drugs (NSAIDs) and the cost of common NSAIDs include Motrin at $12/script, Naprosyn at $9/script, Mobic at $7/script, Celebrex at $35/script, and Etodolac at $47/script.[40]

Aim 3: Between-group differences in number of visits to RTW were assessed for patients with MSK disorders. Do PTs acting in the role of PCMs for patients with MSK disorders demonstrate a significant difference in the overall cost of care to include number of visit to RTW compared to patients with MSK complaints who are managed by MDs, DOs, PAs, or ARNPs acting as PCMs?

Aim 4: Between-group differences were assessed for patients with MSK disorders regarding number of visits used to determine provider cost of care. What are the differences between patients with MSK complaints who are managed by PTs compared to patients with MSK complaints who are managed by MDs, DOs, PAs, or ARNPs acting as PCMs? The cost of

one visit to a MDs, DOs, PAs, or ARNPs is averaged at $200. The cost of one visit to a PT is averaged at $100 a visit.[42]

Relevance and Significance

Rising health care costs in the United States have been a challenge for decades. At the beginning of the 20th century, health care cost as a percentage of gross domestic product (GDP) was 0.25%.[43] Following the passage of the Medicare and Medicaid Bills in 1965, health care spending increased rapidly, reaching 2% of GDP in 1970 and 3% in 1980.[7,44] As a share of the economy, the government estimated that health care will account for nearly 20% of the U.S. spending by 2024, up from 17.4% in 2013.[45] As health care costs continue to outpace cost-of-living indexes, alternatives such as using PTs to care for a well-defined population warrants examination.

Although not commonplace, case managers are beginning to understand the cost effectiveness and the direct access capability of PT services.[12, 13] In these areas, instead of waiting on physicians to refer patients to PTs, case managers have eliminated the need for a physician PCM referral by cutting out this step and coordinating care sooner.[12] This effort has also led to decreased cost and increased patient satisfaction. Virginia Mason Medical Center in Seattle, Wash., in cooperation with some of the state's major employers that use Aetna as the payer, investigated the cost of care for patients with back pain. The goal of the investigation was to cut costs, streamline care, and improve outcomes. The review demonstrated that most patients went through a lengthy wait period between tests and a reexamination by the physician, and that eventually the doctors referred the patients with MSK disorders to a PT. In most cases, the patient did not see any lasting improvement until after care was provided by a PT.[12] They streamlined the process to mandate that patients with low back pain are examined by a PT before

any other imaging occurs and before the patient is referred to a specialist, and often this occurred on the same day. Even though the physicians have streamlined the process, patients must still see the PCM to clear them from any potential red flags or issues that are deemed potentially emergent. Red flags are defined as any serious medical condition to include referred pain from internal organs and pain from non-MSK conditions such as tumors or cancers. Many organizations argue that PTs are not trained in differential diagnosis and as such should not be seeing patients who have not first been screened by a PCM.[46] In patients with low back pain (LBP), PTs have demonstrated the ability to screen patients asking the appropriate questions to rule out potential serious pathology.[47] This more efficient process means wait times for definitive care have dropped to one day. Within the first year of program implementation, MRIs dropped almost 40%, and lost time from work dropped 94%. The only criticism of the streamlined process came from the hospital, as there was revenue loss in radiology. Muller[12] stated, "Although the initial push for the change was cost savings, patients have benefited overall by receiving effective care earlier, which in the end has shown decreased cost due to complications of untreated conditions."

According to Childs et al., [48] PTs demonstrated diagnostic accuracy on par with orthopedic surgeons and were significantly more accurate in determining a clinical diagnosis than non-orthopedic primary care providers. Childs et al.[48] found that PTs were judicious in ordering expensive diagnostic tests. Ross et al.[49] compared knowledge managing LBP between Air Force PTs and family practice physicians, finding that there was a greater likelihood that PTs would recommend the correct drug treatments for patients with acute LBP compared to family practice physicians (85.2% vs. 68.5%; relative risk: 1.24 [95% confidence interval: 1.06-1.46])

and believe that patient encouragement and education is important for positive outcomes (75.9% vs. 56.2%; relative risk: 1.35 [95% confidence interval: 1.09-1.67]).[49]

During the Persian Gulf War, the U.S. Navy used PTs as physician extenders.[50] Ziemke et al.[50] noted that PTs on ships saw 3,373 patient visits during a 1998-1999 Western Pacific deployment. They reported medical staff statements that having PT personnel onboard resulted in fewer patient visits for MSK problems and fewer evacuations compared with other similar carrier deployments. Also, PTs in the uniformed services demonstrated higher scores for evaluation and treatment decisions than medical students, physician interns and residents, active duty military physicians, and all other physician specialists except for orthopedists.[19,48] In another model within the Canadian health care system, civilian PTs have direct access capabilities.[51] According to a report by the APTA, these clinical privileges were granted due to physician shortages. Canadian PTs have functioned successfully in this role, and patients have described great satisfaction with the ability to see a therapist without the wait time of obtaining a referral from a primary care physician.

Practical Applications of the Findings

The results of this study may contribute to the APTA's lobbying effort for more payers and employers to consider supporting the inclusion of PT as a primary care provider. As politicians and physicians debate the topic of direct access at the state and federal levels, there is a need for additional research that explores autonomous practice.

According to a report on the curriculum of the 122 U.S. medical schools, only 50% of the schools provide any training in MSK evaluation.[31,34,52] Only 51 of the 141 M.D. medical schools programs in the United States have a dedicated preclinical MSK course, only 25 of the schools require a clinical course in MSK medicine (rheumatology, orthopedics, or physical medicine and

rehabilitation), and 57 of the schools require neither a preclinical nor a clinical MSK course.[32,52] All 33 of the osteopathic programs in the United States do require course work in MSK evaluation and orthopedic manual therapy, but about 75% of those hours are devoted to osteopathic manual manipulation and practice of this skill set in a laboratory setting.[53] According to CAPTE, the physical therapist professional curriculum includes content and learning experiences in the clinical sciences to include MSK and neuromuscular systems, as well as the medical and surgical conditions frequently seen by physical therapists. All DPT programs must contain course work in MSK and neuromuscular systems.[16]

The training in management of MSK conditions varies greatly among individual providers who serve as PCMs. General internists, who normally see patients over the age of 18, will spend three years in post-graduate training with MSK training only being an elective rotation.[54] Pediatric residents do spend a great deal of time training in childhood development and MSK conditions, but general pediatricians refer to orthopedic pediatricians when needed.[56] A survey of family practice physicians found that 51% of respondents felt they had insufficient training in orthopedics.[34] Furthermore, 56% of those surveyed claimed that medical school was their only source of formal MSK training.[32,37,56] Similarly, in another study, pediatric residents reported that despite spending a great amount of time in didactic MSK course work, they had the least-adequate clinical training in orthopedics.[56] Although these studies demonstrate subjective deficiencies in the quality of MSK training, a landmark 1998 study published in the *Journal of Bone and Joint Surgery* demonstrated objective and quantitative deficits.[31] The Matzkin et al.[31] study involved a 25-question, MSK-competency survey validated by the chairs of orthopedic residency programs across the country and administered to 85 incoming residents of all

specialties at the University of Pennsylvania. The survey included questions of a general orthopedic nature. The failure rate in the Matzkin et al.[31] study was 82%.

The nursing profession has been challenged with some of the same issues as PTs concerning direct access. But nursing providers, specifically ARNPs, have a strong base of evidence that supports autonomous practice. A randomized, controlled trial published in the *Journal of the American Medical Association* supported the hypothesis that primary care outcomes do not differ between nurse practitioner (NP) and family practice physician delivery of care.[57] These findings supported and opened the door to increased use of NPs. Physical therapists need to conduct similar quality studies to support the efficacy of the direct access PT practice model. The military is currently the only practice environment in which PTs can practice autonomously and in which reimbursement does not drive the process. It could be argued that the United States will continue to see cost increases because often the correct provider is not functioning as the entry-point provider for patients with MSK conditions.

The overwhelming body of evidence should lend support to the inclusion of PTs in a variety of settings to serve as gatekeepers for patients who present with MSK conditions. This advancement would streamline the process of patient recovery, and lead to seeing the most appropriate provider at the correct time. As health care costs continue to increase, researchers must assess innovative models to staff qualified health care providers. The addition of practice credentials would give PTs the ability to order certain medications, as well as laboratory and imaging studies, and would also give them the ability to limit work-related duties and be reimbursed for services including referral to other providers. Such models need to be fully assessed in the literature.

This study used an exploratory, retrospective, non-experimental, cross-sectional, and quantitative design. The researcher performed tests to measure associations between variables and to make comparisons between PCM groups, and therefore, methods involving both correlational and comparative design were used. Hierarchical linear regression and hierarchical logistic regressions were used to test the hypothesis that PTs care is significantly less costly PCMs for patients with MSK conditions than traditional PCMs. Bi-variate relationships between the factors of the demographics, comorbidity, treatment, MSK groups, PCM groups, and the dependent variables relating to the cost of care were investigated. The comparison of the five PCM groups occurred within the framework of the regressions and correlations. Thus, the author used correlational methods for the comparative element of the study.

Descriptive data included the mean and standard deviation. Demographic data included age, gender, occupation, comorbidities, pain rating at initial visit, body part of injury, number of visits to return to work.

Independent variables.

1. Care provided by non-PT PCMs.
2. Care provided by PTs.

Dependent variables.

1. Imaging use, to include frequency and cost.
2. Medication use, to include frequency and cost.
3. Number of visit to RTW.
4. Cost of care.

The Air Force Medical Service Analytics Axiom Resource Management Inc. extracted data from the electronic health care record over a period of 18-months. No patient identifiers

were forwarded from the Air Force Medical Service Analytics Axiom Resource Management Inc.

Resources

The practice setting was an Air Force, DoD outpatient orthopedic clinic where care is provided to approximately 80% of patients with MSK conditions through direct access. Providers who function as entry point providers recorded patient visits in the military electronic record system, Armed Forces Health Longitudinal Technology Application (AHLTA).

Summary and Discussion

Delivery of health care within the U.S. is changing. Continued reliance on a physician-directed delivery model has not led to improved care and decreased cost. The ability to provide safe, efficient, and cost-effective care through delivery models other than physician-led models has been demonstrated within the civilian sector by ARNPs operating as independent practitioners in 19 states.[58] Health care providers continue to specialize in meeting the needs of specific populations – for example, PTs who treat MSK conditions could offer a viable option for patients with non-complicated issues. The foundational education is included in DPT programs for primary care PTs, with the barrier to effective clinical translation being the limited opportunity to use those skill sets. On average, military PTs complete 10 - 12 days of additional training that builds on the foundational materials taught in PT school, which then allows credentialing as a PT primary care independent practitioner.[3] Medical school students, advanced practice nursing students, and PAs all have clinical internships or rotations that allow them to practice material learned in each of their separate programs, which allows them to function as primary care providers. Doctoral PT programs contain didactic material that would also allow PTs, who choose to practice in primary care, the skill sets required to function in that capacity.

Changing PT state practice acts to allow privileges that would assist PTs to practice independent of PCM oversight is a starting point. All 50 states allow some form of direct access PT. However, without the ability to order medications, imaging studies, and laboratory tests and without the ability refer patients to other providers, the civilian PT is limited in the scope of practice and, as such, the patient is still required to see a physician or other designated PCM for referral. Comparing PT practice patterns to those of family practice providers is essential to the PT profession as it continues to push for full, autonomous practice.

The APTA strongly supports the implementation of PT direct access care.[5] This study explored primary care PT for patients with MSK conditions. Pathways to the recognition of non-physician practitioners who function as PCMs will also be examined to provide context to the efforts of PTs seeking similar scope of practice privileges. PCMs will be defined, for the purposes of this paper, as family practice and internal medicine physicians, pediatricians, PAs, or ARNPs.

Review Rationale

In recent physician supply models, predictions of the number of physicians needed to maintain a healthy population are based on population growth and aging. The projection is estimated to drive a 22% increase in demand for physician services between 2005 and 2020.[60,61] Growing public expectations and the ability to pay for higher levels of care due to economic growth could substantially increase demand above these baseline projections. Factors that may offset the growth in demand for physicians include: improvements in productivity such that each physician can care for a larger population; scientific advances that can contribute to improved health; and the increased use of non-physician clinicians.[29,62] Using non-physician clinicians to

provide care for certain patient populations has been a viable option for the past 30 years in the United States. [57,62,76,99]

Direct access PT is currently allowed in all 50 states. Individual state PT practice acts, which are regulated by state legislation, limit the PTs ability to practice up to current education level. State legislative scope-of-practice limitations do not allow civilian PTs to function as autonomous PCMs with the right to prescribe medication, order laboratory studies, and refer patients to providers other than a primary care provider. Wisconsin is the first state to have recently passed a law allowing PTs to order radiographs, with a few caveats[63] -- specifically that the PT must coordinate ordering with the patient's PCM, and that the PT must hold a clinical doctorate degree or be board certified in a PT specialty. PT in Motion[63] reported that the law was changed to give PTs image-ordering privileges secondary to increased cost and patient wait time incurred to see their PCM, who, as the study reported, would then place the order for the imaging.

For this study, full, unrestricted, direct access to PTs without physician oversight was defined as the ability to contribute to the management of the patient's condition to include the following: ordering of imaging and laboratory studies, writing prescriptions, referring to the appropriate provider if the patient's condition is out of the PT's scope of practice, determining restriction from work-related activities, and being reimbursed by payers.

When a military PT deploys, he/she serves in a location that is not the assigned home duty site. This duty can be in support of any DoD-sponsored effort. Deployment of military PTs has advanced from care offered exclusively at large non-combat-located medical centers to PTs serving as health care entry-point providers for non-battle-related MSK injuries in front line MTFs. In a descriptive, cross-sectional survey study that looked at the perceptions of other

medical providers during Operation Enduring Freedom and Operation Iraqi Freedom, researchers examined how PTs impacted the medical mission.[64] A total of 210 surveys were distributed to medical providers who had contact with or referred patients to PTs, excluding mental health or dental providers, with 51% responding to the 10-question survey. Responses were received from 52 physicians and 55 non-physician providers, to include PAs and ARNPs. The survey addressed three general topics: diagnosis and treatment; ancillary support to the health care team; and impact on medical evaluations. Ninety-two percent of respondents said they considered PTs to be the experts in the assessment and diagnosis of MSK disorders (n = 98). Eighty-two percent indicated they felt comfortable with PTs seeing all MSK patients without referrals. When ordering radiographs for MSK patients, 86% of respondents said they would, at some point, consult with a PT regarding the results, although only 35% reported they actually did so more than 50% of the time. Ninety-seven percent (n = 104) said that PTs in their location made a moderate or significant impact on the overall mission. Seventy-four percent noted that having a PT in the clinic allowed soldiers to stay in place for care instead of being sent home. There were no significant differences in physician versus non-physician responses. PT providers demonstrated their worth as a well-respected and necessary member of the medical team.[64]

Even though multiple studies demonstrate the effectiveness and efficiency of direct access PT, there are many factors that affect the advancement of PTs as autonomous providers, such as the influence of the American Medical Association (AMA). The AMA is resistant to PTs practicing without some degree of physician oversight, a sentiment manifest in the association's powerful lobbying efforts to slow the progression of PT direct access in the United States.

The following section takes a closer look at the history of the AMA and its impact on the expansion of the scope-of-practice for PTs. Physician specialization has been beneficial to

patient care and improved outcomes, and PTs are positioned to be valued members of PCM teams by providing direct access services as specialist in non-operative MSK care.

Chapter 2: Literature Review

Physicians

At the turn of the 20th century, U.S. medical school education had no oversight or standardization, and as a result, physicians of all education and skill levels graduated from these schools. Safe health care for the U.S. population was of major concern to the AMA.[65] In 1906, the AMA became involved in U.S. medical education, formulating standards to address the issue of patient safety. The AMA, to maintain an unbiased assessment of U.S. medical schools, contracted with the Carnegie Foundation for the Advancement of Teaching's education branch to oversee the effort. The foundation appointed Abraham Flexner.[65] who although not a physician, had extensive experience in teaching and educational theory. He understood the value of peer-accepted scientific evidence as the foundation for medical education. Flexner also had a thorough knowledge of European medical programs, specifically those in Germany. Prospective medical students had a rigorous acceptance process as well as requirements for students to strictly adhere to scientific training, clinical internships, and standardized testing before conferment of a medical degree. The results of the Flexner report transformed U.S. medical education.[65]

Due to the poor quality of medical schools at the time of Flexner's investigation, the number of schools slowly decreased from a high of 162 in 1906 to only 69 by 1944. Today, U.S. medical schools have yet to reach the number of programs that were available in 1906. The limited number of medical schools has affected the supply of U.S. physicians. The Flexner report gave the Council on Medical Education (governed by the AMA) the ability to control the number of medical schools. The AMA reports that its efforts to standardize medical education was fueled primarily by a concern for public safety.[66] However, if AMA policies and legislation that limit physician supply result in decreased access to care, then alternatives to meet increased patient

care demands must be investigated. Non-physician providers such as PAs and ARNPs, who frequently serve as PCMs, are filling the gap in U.S. primary care medical services due to a shortage of physician primary care providers.[57,62,76,99]

Physician Specialization

Multiple military conflicts occurred during the 19th and 20th centuries. Medical specialties like general surgery, orthopedics, psychiatry, and neurology were in demand due to the wounds, both physical and mental, seen by war-time medical providers. By the late 19th and early 20th century, medical knowledge and treatment options had improved, which allowed providers to specialize in specific areas. The introduction of medical specialists changed attitudes among physicians, who realized that focusing on one area of the body, or a general area, allowed a physician specialist to offer more concentrated care, resulting in better patient outcomes.

Currently, direct access to PT care could be considered a continuation of the medical specialization that began at the turn of the 20th century. Rising health care costs and physician shortages are facilitating increases in scope of practice privileges for non-physician practitioners. A study from the United Kingdom, which reviewed articles published between 1980 and 2011, assessed the impact of PTs who practice in direct access or advanced scope of practice roles.[67] The researchers searched three databases (Medline, CINAHL, and Embase) using key words: profession (physiotherapy), intervention (advanced practice), outcomes (patients, other health care providers), diagnostic ability (compared to other health care providers), emergency medicine and MSK. Inclusion criteria for the studies contained the following: related to physiotherapists practicing in new roles; addressed the impact and competencies of physiotherapist's diagnostics and triage capabilities; were published in French or English; focused on MSK care; and compared advanced practice physiotherapy care to typical care

delivery models. The researchers divided the studies into four categories: diagnostic agreement between orthopedic physicians and physiotherapists; physiotherapist's treatment effectiveness; economic impact of physiotherapists; and patient satisfaction compared to other health care providers. A total of 16 articles out of 4,139 citations met all inclusion criteria. Methodological study quality varied greatly from a high of 93% to a low of 25%. The studies were ranked for quality based on the four categories and scored according to detailed predetermined validated appraisal tools for each category. The results showed that agreement between physiotherapists and orthopedic surgeons regarding diagnosis and triage for potential surgical candidates was high (k = 0.69 - 1.00), with treatment recommendations rated as fair to very good (k = 0.52 - 0.70). Diagnostic imaging or surgery was the gold standard for diagnostic accuracy. Diagnostic accuracy for physiotherapists was equal to orthopedic surgeons and superior to all other providers including all non-orthopedic-based physicians, podiatrists, ARNPs, and all PAs. In the United Kingdom, the measures of physiotherapist effectiveness in an emergency department or orthopedic clinic showed that physiotherapists prescribed fewer medications and injections, gave more advice regarding functional duty limitations, used fewer assistive immobilization devices, referred more patients to continued physiotherapist care, and sent patients less frequently to orthopedic physicians than other ER providers did. The cost of care was significantly lower for physiotherapists than for other ER providers who also evaluated MSK patients.[67] Patient satisfaction was higher when seen by physiotherapists, but this could be a result of the time spent with the patient, which was almost double for physiotherapists compared to other ER providers. The Desmeules et al.[67] study demonstrated that for patients with MSK issues, the care and cost of care provided by physiotherapists might be equal – or in some cases better – than care provided by traditional care models.

Even though some physician organizations state that PTs are not properly trained to see patients without a PCM screening, the literature does not support this position.[18] In fact, *The Guide to Physical Therapist Practice* lists MSK disorders as one of four primary practice patterns that physical therapists are qualified to evaluate and manage.[5] Physical therapists have demonstrated safe practice by providing patients with competent differential diagnostic measures to determine when the patient should get a referral to their PCM. When patients are referred to PT, the patient is still fully screened for appropriateness of care. If, by differential diagnostic measures, the patient is deemed to be out of the scope of PT practice, then the patient is referred to the appropriate provider. In a review of the literature, 78 case reports described PTs referring patients back to the PCM with a diagnosis of a missed medical condition.[25] The review of published case reports looked at 58 patients who were referred to a PT and 20 patients who had sought care from a PT through direct access. Boissonnault and Ross[25] reviewed every print issue of *Physical Therapy Journal* (PTJ) and the *Journal of Orthopedic & Sports Physical Therapy* (JOSPT) between 2004 and 2009 for case reports or case series. Patient referral to PCM by PT was the main inclusion criteria. Data extracted from the selected studies included: (a) how patients accessed physical therapist services (whether through direct access or by physician referral to the physical therapist); (b) when the patient was referred to the PCM (at the initial visit or at a follow-up visit); (c) resultant medical diagnosis following patient referral to the physician; (d) who initiated the patient referral for diagnostic imaging; (e) patient history (primary presenting symptoms); (f) patient health history; and (e) physical examination, including systems review. The mean patient age was 40.8 years and there were 44 male patients and 34 female patients in the cases reviewed. Most patients in these case reports were referred to PT by a physician PCM, with about 25% of the cases accessing PT without a referral. Therapists

identified four cases based exclusively on clinical presentation and physical examination of four patients who, once referred to the referring provider, were found to have pathological fractures. Patients who were referred to the PCM at the initial PT visit had symptoms including suspicious pain (76.9%), weakness (5.1%), and tingling and numbness (2.6%). These case reports are examples of how PTs can work closely with physicians to ensure that patients receive safe, appropriate care from the appropriate provider.[25]

Physician Supply

As early as the 1920s, the medical literature warned of an impending physician surplus for primary care medicine and physician specialists.[68] Physician supply and demand projections have changed throughout the past century, and some would argue that physician supply was noted to be in surplus until non-physician health care providers begin to fill roles of primary care physicians.[69] In the early 1980s, as ARNPs and PAs begin to fill roles traditionally filled by physicians, a new model of population projections was reported, which projected a significant shortage in physician supply not only in primary care but in specialist positions as well.[70]

Current estimates, based on the 2010 National Ambulatory Medical Care Survey and the 2014 American Medical Association Masterfile, indicate that by the year 2035, the United States will require an additional 44,000 primary care physicians.[71] The Petterson et al.[71] report applied the use of ambulatory primary care services and the U.S. Census Bureau's 2014 results to project demographic changes. To determine the baseline projections of needed physicians, the 2014 AMA Masterfile used the current number of primary care physicians in the United States and the number of primary care physicians projected to retire at 66 years of age. The annual production of primary care physicians was estimated using Specialty Board and American Osteopathic Association figures.[71] These calculations used complex algorithms that included area population

density, transportation routes, income, migrant worker data, health care service high utilizers, and multiple other demographic measures to analyze physician demand. As a broad rule, the national consensus is that the United States has a 3,500:1 ratio of patient to physician in most areas. According to the most recent reports, a ratio of 2,000:1 is required for there to be no shortage of physician PCM providers in the United States.[72]

One result of the physician shortage is an increase in the numbers of non-physician health care practitioners filling PCM roles. Although the expansion of physician extenders is occurring in the United States, the AMA does not support these expansions of scope of practice for non-physician providers. The AMA has insisted that physicians are the only providers who can safely act as the front-line provider for patients to enter the U.S. health care system.[74] The Flexner report, which was supported by the AMA, argued for the use of scientific evidence as the foundation to support changes it deemed necessary for safe medical education. However, some would argue that the AMA is ignoring evidence that non-physician health care providers can deliver safe and effective primary care medicine.[38,51,62]

The implementation of the Patient Protection and Affordable Care Act (ACA) on March 23, 2010, has resulted in 34 million new patients entering the healthcare marketplace. The result of the federal statute in addition to the factors of population growth and an aging society, is an increased demand for primary care services and a greater need U.S. primary care providers.[73] The Obama administration recognizes this shortfall and has called for an immediate and long-term expansion of programs that will train additional physicians, ARNPs, and PAs to provide primary care services.

However, in response to the ACA call for non-physician PCMs , the AMA has not supported non-physicians serving as PCMs. The AMA again noted that physicians are the only

health care professionals who are qualified to serve as entry point providers because of their years of education compared to non-physician practitioners.[83,84,85] But the position of the AMA is not supported in the scientific literature, specifically in regards to safety of non-physicians in primary care medicine, as the literature shows no support for the idea that additional medical school education has an effect on safety and patient clinical outcomes when compared to non-physician PCMs working within their scope of practice.[86,87,88,89]

Some of the effects of the current PCM shortages affect emergency departments, where hospitals have seen rising costs, unnecessary treatment, and an overall increase in levels of emergency department visits.[75,76] As noted, this trend has been linked to the lack of primary care providers, an aging population, and insufficient use of referral practices by PCMs.[76] Physical therapists have been used effectively in the emergency department to lower costs, improve patient outcomes, and decrease patient admittance.[76,78] Studies show that 15% of all ER visits are for MSK injuries, with 80% of those injuries labeled non-emergent.[77] In a study examining the efficiency, cost, and management outcomes of advanced practice PT in Australia, the researchers found that these PTs could manage a caseload independently, provide safe care, and prudently use available resources.[78] The study looked at 1,017 patient charts over a six-month period. Fifty-five percent of the patients were male, with an age range of 25 to 52 (mean = 34). Approximately 50% of the patients were managed independently, with the other 50% requiring imaging or lab work to clarify the condition. Ninety-five percent of patients were all seen within four-hours. Advanced practice PTs were found to be more time efficient when evaluating MSK patients than emergency department physicians.[78]

To compound the shortage of U.S. physician PCMs, the annual report of the American Academy of Family Physicians (AAFP) reported that the number of U.S. students going into

family medicine residencies continued to decline – in fact, 2012 showed less than 7% of all graduating medical students entering a family practice residency program.[79] In New York state, 106 hospitals and health care systems outside of New York City completed a survey addressing physician shortages. It was reported by 61% of respondents that there are times when their emergency room is not covered by certain specialties, requiring them to transfer patients elsewhere. In upstate New York, that number jumped to 71%.[79] Hospitals (81%) are trying to hire more primary care physicians, but 69% reported that they are having difficulty recruiting these doctors because there are not enough physicians to fill the positions.[80] Reimbursement for services is a driver for physicians to opt for practice in an area other than primary care or family medicine. Many states are now advocating for PAs and ARNPs to see patients in underserved areas, offering loan repayment and other state and federally funded loan repayment and incentive programs.[53]

Frequently, it is difficult to get a same-day health care appointment with a PCM, which has resulted in a dramatic increase in urgent care and ER use, which is not only costlier but defeats the purpose of having a PCM.[81] The PCM model is designed to manage health care and help prevent illness and disease processes. Since the '90s, the number of urgent care clinics has more than doubled. The average cost of an urgent care visit is $150, compared to $1,354 for an ER visit; but compared to the average cost of $75 for a PCM visit, the use of ER and urgent care providers increase healthcare cost.[82] Urgent care centers and ER fast track paths were born out of the lack of PCMs.[81,82] This trend has resulted in patients visiting doctors only when sick, or a "sick-care system" instead of a "health care system. Emergency rooms and urgent care systems are not designed to provide preventative care or manage chronic disease. The focus of the ACA is to allow PCMs to change their practice to drive better health outcomes, standardize care, save

costs, and manage patients' health conditions to control cost and prevent diseases that typically are more expensive to treat.[81]

Health care maintenance organizations addressed the physician PCM shortage more than 30 years ago by using more PAs and ARNPs as non-physician PCM providers.[70] As a result, PAs and ARNPs have made significant progress serving as PCMs and proving to be safe and effective primary care providers.[70] Both professions have helped to fill the gap in the shortage of PCMs caused by the lack of physician providers.

In a study that examined the quality of primary care delivered by NPs compared to family practice physicians, no significant differences or issues with patient safety emerged.[85] The Mundinger et al.[85] study examined NPs and family practice physicians who had equivalent patient management responsibilities. The study spanned four community-based outpatient centers staffed by 17 physicians and seven NPs. The NPs saw patients without a referral or physician oversight. The study focused on 1,081 patients who were randomly assigned to NPs or physicians for follow-up care after being seen in an ER or urgent care clinic. Study participants were evaluated at two separate clinics with either NPs or family practice physicians serving as the sole PCM. The main outcome measures included SF-36, which is a set of generic, coherent, and easily administered quality-of-life measures, as well as usage index, and patient satisfaction with follow-up at six months and one year. No significant difference surfaced in the complexity of the patients' conditions. The study hypothesis of similar patient outcomes was strongly supported by findings of no significant difference in outcomes. But despite positive results, safe delivery of care, and lower costs because of non-physician providers seeing patients without physician oversight, physician groups continued to insist that health care should only stem from physician-led teams.[74]

Physician education as compared to non-physician provider education has not translated into safer, more cost-effective care when looking at primary care medicine.[75,88,90,91,92] On the contrary, as far back as 1997, Mitchell and de Lissovoy[91] reported that PTs seeing patients without referral were less costly, required fewer visits, and yielded shorter episodes of care overall. However, a common misconception is that direct access PT would lead to increased cost, decreased patient safety, and ultimately to PTs practicing beyond their scope of practice and assuming the role of a physician.[91,92] The Mitchell and de Lissovoy[91] study, based on claims data, examined resource use, and cost of direct access PT care compared to physician referral. Blue Cross-Blue Shield of Maryland health insurance claims data was examined for claims paid for direct access PT care. In tests for differences of means, physician referrals showed 67% more claims and 60% more visits ($P < .0001$). Furthermore, when the patient was referred by a physician to a PT, reimbursement frequency for the physician-ordered PT services was 57% greater. Physicians would order a specified number of visits over a specified period of weeks, which frequently had patients attending multiple PT sessions instead of allowing PTs to determine when and how often the patient needed care. When direct access episodes were measured regarding direct claims for PT services, PTs demonstrated prudent use of services and provided care that was 137% less expensive than the care provided in episodes classified as physician referral. Of note, some of the direct access PT care episodes included a referral to a physician, which is critical because it demonstrates that PTs are referring to the appropriate provider if warranted.[91]

It is likely that the physician's gatekeeper model, designed on the assumption that the PCM physician practice model would lead to the most cost-effective way to care for patients, is contributing to the rise in health care cost. Many physician specialists have been affected by

using PCMs to sort patients for referral, reporting that often referral care is delayed.[93] It may be time for the oversight of U.S. organized medicine to shift to a group of professionals from various medical, legal, and business backgrounds who would have a clearer, better-rounded view of U.S. medical care.

In 2012, the AMA produced a list of 10 distinct, non-physician health care licensed professions that are seeking scope-of-practice expansions, which, if approved, the AMA deemed as harmful to the public.[46] The lobbying campaign of the 10 professions was expressly intended to educate lawmakers on the public hazards of allowing approval of this legislation.[46] The AMA's Scope of Practice Data Series, which is currently awaiting an update, includes an in-depth report on each of these 10 professions: audiologists, naturopaths, nurse anesthetists, NPs, optometrists, oral and maxillofacial surgeons (dentists), pharmacists, physical therapists, and psychologists.[46] In the scope of practice commentary, PTs can be compared to orthopedic surgeons, with the conclusion being that educational levels of PTs and orthopedic surgeons are not comparable.[46] This comparison of PT education and orthopedic education is unjust, as comparing these two distinct professions is not logical. Physical therapists are not trained in surgical procedures, just as orthopedic physicians are not trained to rehabilitate patients. However, in a comparison of PT and orthopedic surgeons, their clinical diagnostic accuracy results were interesting and showed similarities. In a non-experimental, retrospective designed study conducted by Moore et al.[20] the researchers compared the clinical diagnostic accuracy of PTs, orthopedic surgeons, and non-orthopedic providers. Keller Army Community Hospital in West Point, N.Y., which uses PTs as a front-line providers for patients with MSK injuries, was the setting of the study. MRI findings were the gold standard to confirm diagnostic accuracy of the assessment diagnosis. The retrospective medical chart review looked at the agreement

between MRI findings and clinical diagnosis for 560 patients over an 18-month period. Analysis of agreement between clinical diagnosis and MRI findings produced a clinical diagnostic accuracy of 74.5% (108/145) for PTs, of 80.8% (139/172) for orthopedic surgeons, and 35.4% (86/243) for non-orthopedic providers. There was a significant difference in clinical diagnostic accuracy between PTs and non-orthopedic providers ($P < .001$) and between orthopedic surgeons and non-orthopedic providers ($P < .001$). There was no statistical difference in clinical diagnostic accuracy between PTs and orthopedic surgeons ($P < .05$).[20]

The AMA may not fully appreciate the level of education required to become a PT. This misunderstanding emerged in an advertisement circulated by the New York Society of Orthopedic Surgeons, which had a poster showing a patient with back pain and a caption that read "Are you trained to recognize the bone tumor in the lower back? Neither is a PT."[94] It should be noted that neither is an orthopedic surgeon trained to do so without diagnostic imaging and lab work to confirm the diagnosis. Each patient who is seen by a PT, whether through direct access or by referral, goes through a systems differential diagnosis and medical screening for appropriateness of care. Medical screening for pathology in patients is standard of care for patients seen by PTs.[95,96] This medical screening process does not involve making a diagnosis but instead is focused entirely on the appropriateness of the patient to be seen by a PT and whether the patient needs a referral to another provider.[95]

The *Guide to Physical Therapy Practice* stated that at the initial evaluation, every patient will receive comprehensive medical screening and testing to determine a diagnostic category, which indicates whether the patient is appropriate for PT care or should receive a referral to another medical provider.[15] In a study that examined PT use of clinical practice guideline compliance to identify and document red flags in LBP patients, the researchers noted that seven

of the 11 red flag items were documented over 98% of the time. Red flags for patients with LBP that were tracked for this study included the following factors: age over 50, bladder dysfunction, a history of cancer, night pain, trauma, saddle anesthesia, immune dysfunctions, any lower extremity neurological deficient, weight loss, recent infection, and fever/chills.[97] The study took place in six private practice clinics in Tacoma, Wash., where 16 PTs reviewed the charts of 160 patients. The results indicated that PTs are safe and well trained, and like physician PCMs who use clinical knowledge and differential diagnostic tests to do so, refer the patients when care is outside of their scope of practice.[4, 95]

Physician Assistants

According to the American Association of Physician Assistants, the PA profession was created in the mid '60s to improve and expand health care.[98] Physicians who were looking for individuals to train as assistants realized there was a very experienced group of military medical corpsmen returning from WWII. Eugene A. Stead, Jr., M.D., of Duke University Medical Center, put together the first class of PAs in 1965.[98] According to the history of the PA profession, Stead selected four Navy hospital corpsmen who had received considerable medical training during their military service. Initial PA classes had the purpose of educating physician extenders. The program was patterned after the fast track (FT) physician programs, which existed before WWII. PA educational programs are three years in length, consisting of 18 months of didactic work and 18 months of clinical rotations. Most PA programs graduate students at the master's level. Course work includes study in anatomy and physiology, diagnostic methods, clinical medicine, radiology, pharmacology, and evidence-based medicine. The clinical rotations include one to two months in areas such as family medicine, internal medicine, pediatrics, orthopedic, general

surgery, emergency medicine, geriatrics, ob/gyn, as well as multiple elective offerings in specialties and sub specialty areas.[99]

The federal government is the largest employer of PAs, where the ratio of physicians to PAs is greater than 50%.[100] The military and other federal health care systems are experiencing the same shortage of PCMs and physicians as the private sector, and as such, the military medical service has used Pas to fill this shortage of physician PCMs.[101] PAs in the military have proven that they can deploy into areas where they function as PCMs to deliver safe, timely care while maintaining consultation practice patterns with their supervising physician, who is normally in a geographically separated location.[102] A study conducted between March 1, 1999, and May 1, 1999, to examine patient satisfaction of PAs used in an ER fast track, showed on average satisfaction rates of 93%.[103] The study staffed the FT clinic with PAs only, which is a normal trend. A total of 111 patients – 56% female and 44% male (95% CI: 90.27 to 95.73) – completed a satisfaction survey that consisted of placing an X on a visual analog scale with rankings from 0 to 100. Counselman et al.[103] noted that 12% of patients would have been willing to wait longer to see a physician instead of a PA.

In a 2012 review of studies examining the contributions of PAs in primary care, it emerged that PAs can contribute to the successful attainment of PCM functions, particularly providing comprehensive front-line care, accessibility, and accountability.[104] The reviewers attempted to assess all available evidence regarding how PAs have contributed to primary care. Hooker and Everett[104] conducted an English language search of studies published between 1990 and 2010, looking for all studies that included primary care PA services. Studies were included in the review if they used an observational or experimental design for measuring PAs and physicians against an outcomes tool and writing up the results for peer-reviewed journals. Forty-

two papers and one monograph met all inclusion criteria for comparing PAs to PCM physicians. Hooker and Everett[104] noted that PAs have demonstrated safe, effective care with high patient satisfaction, and that they practice in underserved areas where access to physician care is limited.

PTs in the military health care system, like PAs, are credentialed to function as PCMs. This practice model was assessed in a recent study looking at all the services. A cross-sectional design study was used to determine the cost effectiveness and knowledge base of PTs in all branches of the uniformed health services – the Army, Navy and Air Force health services and the U.S. Public Health Service – as well as 26 DPT programs.[19] All participants completed an examination created by Freedman and Bernstein[37] to assess knowledge in MSK medicine among physician interns, medical students, and a variety of physician specialists.[31] The exam consisted of 25 open-ended questions that were based on commonly encountered diagnoses as well as common orthopedic conditions that would warrant referral to an ER.[19] A total of 182 PTs in the uniformed services completed the examination, achieving a score of 76% (a passing score is considered 73.1%), which surpassed MSK knowledge of all physicians, residents, and physician interns who scored approximately 54%. Orthopedic surgeons scored about 13 points higher than the uniformed services PTs. The results of this study supported the conclusion that PTs have a knowledge base that is better suited to see patients with common orthopedic conditions when compared to non-orthopedic PCMs, to include PAs.

The services use PAs to provide care in deployed locations. Army, Air Force, and Navy PAs have been deployed in large numbers to support U.S. military personnel, allied troops, civilians, and local nationals in conflicts around the globe.[100] When service members are deployed, they leave their permanent duty location and relocate for a period – normally six months to a year – in support of the military mission. While the number of PAs who have

deployed is not public information, the American Academy of Physician Assistants' Veterans Caucus claims to represent "over 7,500 PAs who are veterans of the Armed Forces."[105] As of 2008, the Army had 698 PAs on active duty, the Air Force had about 275, the Navy had more than 100, and the Coast Guard had 42.[102] Nearly all Army PAs have been deployed at least once. On average, Army PAs have spent 25 months "in the war," according to Col. Michael Robertson, PA-C, who is the Army's chief PA consultant to the Office of the Surgeon General.[102] "I always say it's great to be a PA in any environment, but it's great in the Air Force," said Lt. Col. John Chitwood, M.S., PA-C, who is the Air Force's chief PA consultant to the Office of the Surgeon General. "I have the help and safety of [clinical] military support there when I need it. At other times, when I'm doing things that are routine and simple to me, I just check in with my preceptor as I need to every day or two." However, even in a deployed setting, when you may be deployed a continent away from your preceptor, you can talk to him or her immediately if needed.[102] PAs in the military have a certain amount of autonomy, but as with civilian sector PAs, military PAs must have physician oversight.

PAs in the United States have an established record of providing cost-effective care as far back as the early 1980's.[98,106,107] In a systematic review of the literature, Halter et al.[108]examined the broad-based term contribution of PAs in primary care. Out of 2,167 identified publications, 49 met Halter's inclusion criteria, with 46 publications coming from the United States. Inclusion criteria for the articles examined consisted of the following: (a) the role of PA usage based on the standard medical model of general practice with recognized PA qualification, and (b) the setting of general and family practice medicine including community pediatrics. The findings relevant to family medicine were presented separately from findings meeting a broader definition of primary care, and the publication was a journal article.[90] The study found that in the United States, PAs

only require supervision for about 20% of the patients they see, noting that this decreases as the PA and supervising physician become more comfortable with one another's skill set.[108] In a national survey of Medicare beneficiaries, patients reported feeling very comfortable seeing a PA, and often patients viewed physicians and PAs similarly.[104]

The continued growth of the PA profession in the United States is driving PA usage in other parts of the world. In the Netherlands, PAs remained unacknowledged until 2001, with the first class graduating in 2004.[109] These PAs were not introduced because of a lack of physicians, but rather to help control costs and alleviate the lack of continuity of care for hospital patients. The push for inclusion of providers who could function as physician extenders were fueled by changes in the national health care system. In a study supported by the Dutch Ministry of Health, Welfare, and Sports in 2011, PAs and ARNPs were given temporary practice privileges for five years. These practice privileges are typically give to physicians, dentists, and midwives alone to indicate and perform specific medical procedures (i.e., catheterization, cardioversion, defibrillation, endoscopy, injection, puncture, prescribing, and independent simple surgical procedures).[110] Data analysis was conducted separately for PAs and ARNPs so that results could be examined based on the specialty. The increased practice capabilities are valid for five years and will be subject to evaluation.

The primary aim of the study was to systematically evaluate the effects of granting independent rights to PAs (and NPs) on the process of outcomes of care, concerning each reserved procedure with the framework of the allowed privileges.[110] Bruijn-Geraets et al.[110] used a mixed method design, which allowed them to merge qualitative and quantitative data. This blending of data types supports a more complete, well-rounded understanding of the question.[110] Outcome changes for quantitative data were measured using a one-group, pre-test, and post-test

design. Measures were taken before the changes in practice pattern one year, two years and five years afterward. Measures for qualitative data were collected by interviews and focus groups up to a year after law inception. Qualitative measures were designed to examine existing barriers that could affect the performance of PAs in the newly granted roles. Three surveys focused on data collection: one for patients, one for PAs, and one for supervising physicians. The collected data helped to clarify how PAs performed the 61 specific procedures, and whether they required or sought supervision to perform the task. Cost-effectiveness was measured by the amount of contact with the patient and with the physician, or by extra time resulting from the independent patient management required for the PA to complete the needed services. This study was careful to examine the decision-making process of the PAs by using an analytical hierarchy process method (AHP). The AHP focused on identifying relevant criteria used to determine the correct course of action based on a set of five operationalized criteria: quality of care, cost, use of care, patient-centered care, and general background characteristics. Both patients and caregivers completed the surveys. Creswell et al.[110] invited all PAs (284) and NPs (1,146) in the Netherlands to participate, with each PA or NP asked to invite five patients and two supervising physicians for survey participation. The study took place in two phases, with the first phase assessing the five baseline measures of the study if PAs and NPs can perform these procedures independently, including catheterizations, surgical operations within scope of practice standards (minor outpatient procedures), and assessing their ability to make clinical decisions regarding the use of injections and punctures. It started in March 2011 and ended January 1, 2012. Baseline participation was 1,144 respondents (142 PAs and 1004 NPs). As the new legislation allowing increased practice privileges was slowly put into practice, the researchers gave the first post-test of the second phase, with 750 NPs and 140 PAs responding. The second phase ran from January

2012 through July 2015, with the 2nd and final post-test occurring at the end of 2014 (1,200 respondents). The last post-test showed that for 83% of the NPs and 86% of PAs, autonomous practice power was standard, with 7% of the NPs and 4% of the PAs indicating that performing these five procedures is not necessary for their practice area.

Results showed that based on the five operationalized criteria of quality of care (i.e., cost, use of care, patient-centered care, and general educational background characteristics), all allowed increases in scope of practice privileges proved to be beneficial. All physicians completing the surveys agreed that the skill sets of the ARNPs and PAs were sufficient and safe to allow inclusion of these practice rights.

This study, although not conducted in the United States, has strong implications as to how the profession of PAs will progress in the future. The Dutch Ministry of Health and Sports had the advantage of using performance records of PAs from the United Kingdom and the United States, which helped them fully evaluate the performance of this group of health care providers. It was noted by Creswell et al.[110] that the goal was to provide evidence that fully supported authorization of PAs to independently perform specific medical procedures.

Nurse Practitioners

Unlike PAs, who were created by physicians to fill a specific physician-directed need, nurses were already a mainstay of traditional medicine. Nurses have likely been a named profession since 300 A.D. during the height of the Roman Empire.[111,112] Nurses have provided care to military personnel and civilians in major U.S. conflicts, including the American Revolution, War of 1812, Indian Wars, Mexican War, Civil War, Spanish-American War, World War I, World War II, the Korean War, the Vietnam War, Gulf War, and Operation Enduring Freedom, to list a few. Their efforts led to the formation of organizations such as the Red Cross,

the New England Hospital for Women and Children, and many other groups that are still active today.[113] With their history of patient care, nurses were well positioned to transition into roles that would allow them to function as PCMs. Nurses had excellent clinical and educational qualifications, broad experience, and a long track record of providing care to all patients. As a non-physician profession, ARNPs have made the most significant strides of any non-physician extender in the areas of autonomy and the ability to practice without physician oversight.[87] The nursing profession continues to battle for extension of scope-of-practice privileges that would allow ARPNs to provide autonomous care as a PCM.[87; 88]

The AMA, as the leader of organized medicine in the United States, strongly supports scope-of-practice laws to ensure what they deem as a patient safety concern, to prevent APRNs from providing primary care services without physician oversight.[46] As nurses struggled to increase access to providing primary care in settings that were traditionally staffed by physicians, the nursing profession experienced substantial push-back from the AMA.[114] In a statement posted in 2010, the IOM called for nurses to take on a larger, more autonomous role in the delivery of U.S. health care, and for nurses to practice to the full extent of their education and training.[115] APRNs require a Master of Science in nursing (MSN), post-master's work, or a Doctor of Nursing Practice (DNP) in a specialty such as acute care, adult practice, family practice, gerontology, neonatal care, pediatrics, psychiatric/mental health, or women's health.[116] The AMA, in response to the position taken by the IOM, noted that "nurses are not equal to physicians."[117] Besides reinforcing the importance of a physician-led team approach, the statement underlined the difference in education and training between nurses and physicians.[117] Yin[116] noted that physicians fear they may be losing market share to ARNPs. However, the American Nurses Association was clearly pleased with the statement of support from the IOM.

The association's CEO, Marla Weston, reported that the IOM position was evidence-based and reinforced the notion that ARNPs can function independently as primary care providers. [87,118,119]

These turf battles are not new. For the past 15 years in the state of Florida, ARNPs have lobbied for passage of legislation that would allow them to prescribe controlled drugs such as Valium, Ritalin, and OxyContin. Opponents, specifically the Florida Physicians Association (FPA), noted that this is dangerous, that the ARNPs do not have the proper training to dispense these substances.[120] The FPA argued that it will only worsen the problem of patient addiction to give prescribing privileges to providers other than physicians. Supporters of this increase in ARNP's practice capabilities point out that ARNPs already evaluate and diagnose patients just like primary care physicians do, and supporters note having to take time to get a physician's sign-off on a request for these controlled substances wastes the time of both providers and patients, resulting in added health care costs.[120] It was noted that ARNPs, who are required to have physician oversight for these prescriptive rights, spent eight hours per week conducting this administrative duty. If the physician is not present to sign-off on these requests, then the patient is told to either go to the ER or come back tomorrow when the physician returns.[120]

There are quality studies supporting the practice of ARNPs prescribing controlled substances, and states used the studies to support legislation that passed in the 1970s allowing a change in practice competencies.[121] As part of the Institute of Medicine (IOM) recommendations supporting increased use of ARNPs in primary care, a four-part initiative was put in place by former Health and Human Services Secretary, Donna Shalala, to help guide the process of transitioning more nurses into primary care roles.[122] This single initiative has helped create a structure that is now guiding the nursing profession. The four key initiative messages as follows:

1. Nurses should practice to the full extent of their education and training through the elimination of historical, regulatory, and policy barriers.
2. Nurses should achieve higher levels of education and training through an improved educational system that promotes seamless academic progress.
3. Nurses should be full partners with physicians and other health care professionals in redesigning the system.
4. Government should create a greater capacity to undertake effective workforce planning and policymaking through better data collection and information infrastructures.[122]

Scope-of-practice debates continue at the state and federal levels as ARNPs push for approval of independence and autonomy.

The Congressional Budget Office, which reviewed the initial studies that formed the foundation for legislation to support independent practice, recognized ARNPs as far back as 1979.[122] The evidence in the late 1970s demonstrated that outcomes, diagnostic accuracy, management of particular medical conditions, and patient outcomes of ARNPs were equivalent to physicians.[123]

In a 2002 systematic review, researchers assessed studies that examined the effects of doctor-nurse substitution in primary care.[124] The reviewers examined studies from the United States, Canada, and the United Kingdom, identifying 11 RTCs and 23 observational studies that met the inclusion criteria of direct comparison of patient satisfaction, health status, method of care, and cost. Horrocks et al.[124] reported that the quality of care and patient satisfaction were better for ARNPs than for physician providers and that no significant differences were found regarding prescriptions and return consultation and referrals.[124] Overall the reviewers did not

support the cost benefits of substituting ARNPs for physicians. ARNPs tended to spend more time with patients and therefore were not able to see the volume of patients that physicians were; however, the ARNPs rated higher in patient satisfaction, which could be due in part to the longer, less-rushed ARNP appointments.

In a study titled "NPs as an underutilized resource for health reform: Evidence-based demonstrations of cost-effectiveness," the author reviewed more than 100 studies on care provided by both NPs and physicians.[62] The author reported that these studies demonstrate that ARNPs have equal or better patient outcomes when compared to physicians. The AMA frequently points out that educational levels for physicians are higher than for non-physicians, arguing that the numbers of years of education required to be a physician equates to safer, more effective care. Many criticize medical school curriculum because the first two years of course work consists of course work that students are essentially repeating because the courses were also completed as a prerequisite for medical school. New York University is now offering a three-year medical school, hoping to help minimize student debt and address the shortage of physicians.[125] Before being admitted to advanced NP graduate school, nurses have a demonstrated track record of success in the clinical setting. Pre-medical students do not have a clinical resume when they enter medical school. This is not to discount medical students, but to point out that the clinical experience must factor into the discussions of the qualifications of health care providers. From the first day of graduate school, NP students choose their patient population, so teaching is focused on the student's area of interest from the start.[116] Medical programs teach students on a time-based program, requiring students to spend a set amount of time or see a certain number of cases in order to graduate. In contrast, NP graduate programs use

a competency based method of teaching, with students progressing forward only when they have demonstrated the required skill and knowledge of a specific subject.[116]

A 2010 report from the Carnegie Institute called for a change to medical programs that would start the transition to competency-based teaching, but a member of the AAFP's Commission on Education commented, "Both in medical student education and residency, we believe that if you spend a certain amount of time learning about something, then you must know it."[116] The Carnegie report from 2010 noted the following goals: (a) standardizing learning outcomes and individualizing the learning process; (b) promoting multiple forms of integration; (c) incorporating habits of inquiry and improvement; and (d) focusing on the progressive formation of the physician's professional identity.[126]

Physical Therapy and U.S. Military Health Care

To fully appreciate how the discussion began about patient choice for direct access PT, it is crucial to recognize how the profession has advanced over the course of the last 100 years. The rehabilitation model itself was questioned by physicians when first presented in the late 1800's.[127] President Lincoln recognized the lack of care for patients with physical limitations when he visited injured troops at St. Elizabeth's Hospital in Washington, D.C. Lincoln appealed to Congress in 1865 during his second inaugural address "to care for him who shall have borne the battle, and for his widow and his orphan."[127] President Lincoln's efforts led to the creation of the National Asylum for Disabled Volunteer Soldiers in 1865, which established a national government home for veterans of the Union army's volunteer forces. The name later changed to the National Home for Disabled Volunteer Soldiers.[128] The daily life in the National Home for Disabled Volunteer Soldiers was very regimented and structured as if the veterans were still on active military duty. The overall intent of the homes was for veterans to reenter society, if

possible, with a skill that would allow them to be productive despite their physical limitations. Education and training provided by various tradespeople were included to assist with this effort. Vets were taught to write with the opposite hand if they had lost a limb, or they trained in daily tasks required to care for themselves once they left the home. This early form of rehabilitative therapy was designed to keep the members involved in activities that would keep their mind off of "morbid ideas" and "replace them with healthy, normal thoughts to incite interest and ambition and assist in restoring a lost or weakened function either mental or physical."[128] Even though physical rehabilitation was not formally identified, physical participation in the day-to-day operations of the home was understood to be crucial to the well-being of the veteran. Physical rehabilitation in these homes set the stage for sufficient staffing to handle the anticipated WW1 wounded. In 1917, the War Department's surgeon general hired 1,000 people to attend a three-month reconstruction aid program at Reed College in Portland, Ore.[129] Within a year, the program was lengthened to nine months. These new PT aides or reconstruction aides completed 240 hours of training, had to pass a physical exam, and had to have completed secondary school. Initially, these aides worked under the direction of orthopedic surgeons, neurologists, and psychiatrists. Many Army medical officers were skeptical of the value claimed for physiotherapy, but since they thought it was a fad and would soon disappear, they reconciled themselves to allow it to pass.[127]

The polio epidemic and multiple conflicts in the early 1900's shaped and formed a profession that focused on rehabilitation and the return to function for members of the armed services. By the time World War II was underway, many viewed PTs as technicians rather than health care providers. PTs had deployed to hospitals and medical treatment facilities to care for combat injuries operating under the supervision of the physicians. The advent of antibiotics,

improvements in surgical procedures, and a better understanding of how to decrease infection, all meant that more service members with disabilities returned home.[130]

As medical professionals saved lives because of medical advances, the role of military PTs changed and a new direction emerged. PTs not only helped return injured service members to functional status in society, but also pushed to return them to their pre-active duty jobs and professions. In the Vietnam era conflict, physician shortages – and in particular orthopedic physician shortages – set the stage for PTs to step into the physician extender role for patients with nonsurgical orthopedic conditions. Major Barbara D. Gray, staff adviser on physical therapy to the commanding officer of the U.S. Army's 44th Medical Brigade in Vietnam, Vietnam noted that "PT has finally been recognized as a necessity for early treatment of combat wounds and has received full status as a medical team member with the 44th Medical Brigade… PT treatment administered to the patients after surgery by trained PT personnel would restore patients to duty more quickly."[131] Physical therapy is now a valued and necessary part of the medical team. As medical commanders' gained confidence in the abilities of PTs to provide safe, competent care, military personnel used PTs as the initial medical providers to screen patients for orthopedic physicians. Also, if a PT did not deem the patient a possible surgical candidate, the PT would serve as the primary care provider for the patient by completing the differential diagnosis, ordering any needed imaging studies, lab work, or medications, and offering treatment as well as follow-up to ensure a full return to work.

The first entry-level Master of PT programs were started in 1971 when the Army worked with Baylor University to form the Army-Baylor PT program. One of the main purposes of this program was to train PTs to serve in the military as providers who could see MSK patients without a referral.[3] This new program fulfilled the degree requirements needed for PTs to begin

seeing patients without physician referral and to have competencies that would allow them to function as the MSK PCM.[3] Since the first class graduated from the Army-Baylor program, direct access or self-referral for PT care has been standard practice for Army PTs.[20,132] The U.S. Navy adopted the PT physician extender model for MSK patients in 1981, and the US Air Force solidified direct access as a practice model in 1991.[84] All military services require advanced training through various military education programs that ensure standardization of care when patients access PT through direct access. The positive results and clinical competencies exhibited by military PTs led to the DoD credentialing PTs with the ability to order imaging studies, prescribe certain medications and laboratory tests as well as refer patients to other providers when needed.[20,48]

Physical therapy self-referral by patients who use MTFs have been shown to be safe and described as an effective and efficient patient care model.[20,50] In a retrospective, descriptive study, Moore et al.[20] examined risk assessment for patients who accessed PTs through direct access in a MTF. Twenty-five military sites were evaluated from October 1999 through January 2003, and the researchers examined 95 PTs (88 military and seven civil service), each with about eight years of experience in outpatient orthopedics. Fourteen of the PTs held a Ph.D. or DSc degree, 79 had earned master's degrees, and two had bachelor's degrees. Thirty-six of the providers were board certified by the APTA in either orthopedic, sports, or electro physiologic PT. All but 11 of the PTs in this study (84/95, or 88%) attended the two-week COL Douglas A. Kersey Advanced Clinical & Operational Practice Course – the postgraduate neuro-MSK specialty training conducted in Fort Sam Houston, Texas, by the Army-Baylor DPT graduate school. This 2-week intensive course provide advanced clinical and laboratory education in evidence-based diagnosis and management of patients with MSK injuries, including advanced

topics on differential diagnosis, radiology, and pharmacology. Researchers gathered the following descriptive statistics: total patient workload; number of new patients seen with and without referral; incompetent or negligent care of patients managed through direct access; clinical privileges suspended or revoked as a result of incompetent or negligent care for patients managed through direct access; state licensure suspensions or revocations as a result of incompetent or negligent care for patients managed through direct access; and involvement in litigation for incompetent or negligent care of patients managed through direct access. The study looked at 472,013 patients over a 40-month period. PTs seeing patients through direct access diagnosed Ewing sarcoma, compartment syndrome, nerve injuries, pelvic cyst/mass, ankylosing spondylitis, as examples of pathologies that ultimately needed an additional medical referral. The results showed no documented adverse patient effects of direct access PT. No PT had litigation, and no PT had any changes in privileged credentials.[20]

Musculoskeletal injuries are the most common cause of hospitalizations, outpatient visits and limited duty days among the U.S. active duty military population.[147] Even in actual military campaigns throughout U.S. history, disease non-battle injuries have been more prevalent than combat injuries and attrition.[148] Battlefield conditions and operations often dictate how medical professionals allocate medical assets. Medical providers are frequently stretched to the full capacity of their scope of practice, due to the difficult environment and limited availability of medical providers in combat areas. The U.S. Army initiated the physician extender PT role during the Vietnam War. As mentioned, orthopedic surgeons were overwhelmed with the amount of trauma and non-traumatic MSK conditions presenting to Army medical facilities. As such, PTs were used as the entry point for patients with MSK conditions.[132] Using PTs in this fashion allowed patients with non-traumatic MSK injuries to be assessed and sorted

appropriately. Surgical patients were referred to the orthopedic surgeons, and all other patients were managed by the PTs. This practice model of PTs functioning as the PCM for MSK patients helped to relieve the burden of the shortages in general physicians and family practice providers by providing competent care for patients with MSK complaints and injuries.[19,21,49,84]

The U.S. Military Health Care System (MHS) provides care to active duty personnel, their family members, and their dependents, as well as to military retirees on a space-available basis. The military prides itself on providing "The Right Patient to the Right Provider at the Right Place and at the Right Time."[133] To give patients more control of their care and to place them in the center of their own care, the MHS adopted the patient-centered medical home model in 2009.[133] Over the past 20 years, the MHS has consolidated many large medical centers. As early as 1997, Murray[134] reported that inpatient bed loads had decreased 50% from the mid-1980s. The push to decrease in-patient numbers has driven the reconfiguration of military hospitals to MTFs. The basic MTF model has the MTF functioning as an outpatient super clinic, where some outpatient surgical procedures are performed, but the majority of care consists of non-surgical, outpatient care. The modification in the way MHS care is delivered has also changed the makeup of the MTF provider.

Historically, in both military and civilian sectors, PCMs function as the gatekeeper for all medical care. A physician evaluate patients and then, if necessary, refers to an on-staff physician specialist to evaluate and provide the needed care. The shift in how military medical care is dispensed, coupled with the push to decrease in-patient care volume, has increased the PCM outpatient management load. The MHS is experiencing the same PCM supply shortage and ever-increasing demands for PCMs that are occurring in the private sector, and the MHS is safely using various non-physician providers as PCMs to meet the outpatient demand.

Critics note that PTs, due to lack of training, will miss potentially serious medical conditions and patient safety will be overlooked, but evidence in the literature does not support this position. In a study examining decision-making abilities of PTs in direct access environments, a survey of 12 hypothetical cases was presented. Case scenarios included patient vignettes that covered red-flag symptoms – problems that might mimic MSK conditions, and conditions that contained risk factors for more serious medical issues. For each case, participants decided if they would provide care with no referral, provide intervention and then refer, or refer before any intervention. Three logistic regressions were completed to determine characteristics of participants, and findings showed that 394 participants responded accurately 87.3%, of the time for patients with MSK.[135] The researchers noted that PTs who have an orthopedic or sports specialty certification were two times more likely to answer the scenarios correctly.

In a non-experimental descriptive research design looking at primary care PT, Jette, Ardleigh, Chandler, and McShea[135] took a sample of 212 PTs, a large portion of which were active duty military, and compared them to 250 PTs that had not practiced as PCM's.[84] The study categorized PTs into three distinct groups: primary contact military PTs, primary contact civilian PTs, and non-primary contact PTs. A panel of subject matter experts was selected based on specific characteristics, on their experience with the development of practice analysis survey instruments, on their knowledge of PCM clinical practice, on their knowledge of orthopedic PT and manual therapy, on their status as active duty, inactive, or retired U.S. military physical therapists, and on their previous contribution to the advancement of PT.

The survey instrument included demographic information, professional responsibilities, procedures, and knowledge areas. Demographic information included the highest level of education, board certification, experience, number of years practicing as a primary contact PT,

age, and gender. Professional responsibilities included conducting examinations, performing evaluations, determining diagnoses (not a medical diagnosis, per se, but rather a differential diagnosis for patient appropriateness for PT or referred), determining prognoses, performing interventions, planning discharges, measuring outcomes, participating in primary care professional development, and participating in community health education. The results were interesting but not surprising, given the practice settings of each of the groups. Procedures looked closer at what evaluation procedures occurred (i.e., radiology, medication, labs, and interventions). Knowledge areas included anatomy and physiology, examination, evaluation, diagnosis and prognosis, intervention, clinical pharmacology, diagnostic imaging science, critical inquiry, and ethical/legal considerations. There were too many significant differences to list among the three groups in all areas (professional responsibilities, procedures, and knowledge areas), but the areas with the highest degree of differences dealt with imaging, proper identification of non- MSK conditions, establishing a PT diagnosis, and prescribing medication. This study verified that PTs serving in primary care roles demonstrated significant differences in patient care management skills. With military PTs accustomed to functioning in direct access, it would be assumed these PTs would be more comfortable practicing in this model, and that was the case. The implications from this study should help guide educational curricula as the profession moves forward.

Even with decades of safe, direct-access care offered by military or DoD PTs, patient self-referral is not considered an option by most health care providers, payers, and the general public.[19,20,48] APTA[5] reported that the general public does recognize the expertise of PTs, primarily due to their perception of the PT's increased knowledge based on the Doctor of PT degree. Tricare, the administrator of military insurance payers, has not standardized direct access

privileges for PTs across all regions in the DoD. As a result, depending on the region where the military PT is stationed, referrals to off-base providers are only allowed with approval from the patient's PCM. Educating consumers, payers, and medical providers requires constant effort, and this includes efforts from the practitioners and payers within the DoD.

Civilian Physical Therapy

Many PCMs and orthopedic surgeons considered PT to be a treatment -based profession.[30,94] According to the American Academy of Family Physicians, a PT prescription should include: the diagnosis; the type, frequency, and duration of the prescribed therapy; the goals of therapy; and the safety precautions.[30] Interestingly, the authors noted that the PT must document the patient's progress so that the physician or non-physician PCM can modify the care plan if needed. This practice model places PTs in the technician role, with the referring provider making all assessment and treatment decisions.

Figure 2. Components of a Physical Therapy Prescription

1. Diagnosis to be treated with physical therapy; proper coding should be used to allow for accurate insurance billing and reimbursement
2. Frequency and duration of therapy (e.g., daily for five days, three times per week for four weeks) depending on the condition being treated
3. Specific protocols or treatments that the physician wants the therapist to use
4. Safety precautions (e.g., joint range-of-motion limitations, weight-bearing limitations, illnesses that impact therapy decisions)
5. Physician signature and date are required for a therapist to perform the requested services

Reprinted with permission by "The physical therapy prescription," by K. Marchand, & N. Jablecki, 2007, *American Family Physician,* 1, p. 1661.

Typically, patients are informed by their primary care provider that they need a certain amount of PT. When PT is ordered, the therapists often will receive specific instructions regarding what treatment the patient should have based on the evaluation of the primary care provider. PT described to the patient in these terms is akin to a medication prescription, where

the patient is informed that he or she will need to take medication for a certain time. In the case of PT, the patient is informed that he or she will need a certain amount of PT to resolve their current medical condition. Adjustments to the plan, according to this family practice article, should come from the family practice provider, not the physical therapist. PTs in most states are not legally allowed to alter this order unless the referring provider approves the change to the treatment. Many primary care providers don't view PTs as a referral source that can manage a patient without physician oversight.[30] If a PCM refers a patient to an orthopedic physician, the PCM does not provide an "order" for the orthopedic physician to follow. The orthopedic physician uses his or her clinical skills and judgment to determine the best course of action to address the patient's condition. PCMs recognize that they do not have expertise in all areas of health care and, as such, refer patients to providers that do.

Physical therapists do not practice exclusively under orders from PCMs, who may or may not be physicians. The fact that a PCM has written an order for PT does not preclude the PT from performing a differential diagnostic exam to clear the patient for PT care. All PTs who assess patients and offer direct access care, do so regardless of whether the patient is seen through a referral or whether the patient accessed the PT without PCM referral. If it is determined by the clinical judgment of the PT that the patient is inappropriate for PT care, then the patient is referred to the referring provider. This care model is practiced throughout medicine and does not pertain only to PTs. PCMs perform a differential diagnostic examination on all patients, and if the presentation is out of their scope of care, then the patient is referred to a provider who is qualified to provide care.

Physiotherapy/PT outside of the United States

The United Kingdom's Chartered Society of Physiotherapy has four broad pillars granted to the profession by royal charter in 1920, which guides the profession to this day: (a) massage, (b) exercise and movement, (c) electrotherapy, and (d) kindred methods of treatment.[136] All practice activities performed by PTs must relate to one of the four pillars. The Health Professions Council's Physiotherapy Standards of Efficiency[137] defined scope of practice as "the area or areas of your profession in which you have the knowledge, skills, and experience to practice lawfully, safely and effectively, in a way that meets our standards and does not pose any danger to the public or yourself." In 2012, PTs in the United Kingdom were the first in the world to be granted the right to prescribe medications without physician oversight.

We see an expansion of scope-of-practice for PTs in the United Kingdom, where PTs have been autonomous practitioners since 1977.[138] Since that time, PTs have been able to perform assessments, formulate a medical diagnosis, and treat and discharge their patients, and since 2005, U.K. PTs have prescribed medicines under the supervision of a physician, similar to a PA in the United States. In July 2012, U.K. PTs were the first in the civilian world to be granted the right to prescribe any licensed medication and also to mix medicines before application.[51] After announcing the plan in October 2015, the health minister for England signed into law the full, independent, prescribing rights for physiotherapists. Now, U.K. PTs can prescribe like ARNPs and pharmacists. Under the plans, physiotherapists can prescribe medicines relevant to their scope of practice for a wide range of illnesses such as respiratory diseases like asthma, neurological disorders, rheumatologic conditions, and women's health issues as well as for chronic pain and mobility problems. Phil Gray, chief executive of the Chartered Society of Physiotherapy (CSP), said: "This is another hallmark of a highly skilled,

confident, autonomous and accountable independent profession delivering high standards of patient care. We should celebrate this milestone internationally; we hope that it will lead to other countries' physiotherapists following in our footsteps."[139] The CSP reported that this increase in clinical responsibilities would benefit patients and a decrease cost. "Patients will receive more streamlined care and not be required to 'check-in' with a PCM every so often to approve care by a PT."[139]

Family Practice Physicians

The years from 2010 to 2020 have been titled the "bone and joint decade" by the National Institutes of Health and the Global Alliance for Musculoskeletal Health.[140] However, with recent studies reporting the lack of MSK education in medical schools, coupled with the lack of required orthopedic clinical rotations for most medical students, family practice providers must have adequate skills to serve as the sole primary care examiner or the gatekeeper for patients with MSK conditions.

It was reported that experienced physical therapists had higher levels of knowledge in managing MSK conditions than medical students, physician interns, residents, and all physician specialists except for orthopedists.[48] A report in 2003 noted that only 65 of the 122 U.S. medical schools even required a MSK course.[52] In a study examining basic MSK knowledge of medical students, residents, and staff family practice physicians, almost 80% failed the examination, with an average score of 57% across all groups.[31] The study gave a validated cognitive examination to 334 volunteers who were medical students, residents, and staff physicians, with questions designed to assess the adequacy of their training regarding evaluation and treatment progression of patients with MSK conditions. The study reported a 79% failure rate among those who took the survey.[31] The 155 participants (46.4%) who stated that they were comfortable concerning

their ability to perform a MSK examination had an average score on the cognitive examination of 66%. In a study looking at medical students and PAs knowledge of MSK conditions, both scored poorly on the exam.[141] The study examined 145 medical students and 105 PA students, giving them a 75-question validated test that assessed 14 basic sciences and 61 clinical questions. Medical students averaged 73% on the exam, and the PA students scored 62%.[141] These results are concerning when these providers currently function as the gateway for MSK patients to enter the health care system.

Conclusions

PTs serving as the PCM for MSK patients and factors that influence access to PT without PCM referral is an area that will continue to receive attention. It is also of value to study other non-physician medical providers who function as PCMs in order to understand how their profession has changed and developed. It is difficult to examine all available studies concerning direct access PT services. I have attempted to focus on aspects of safety and educational background as the foundation for moving forward towards increasing scope of practice and practice privileges that reflect the full educational background of physical therapists.

Chapter 3

Methods

This chapter presents an overview of the methodology used for this study. The study design, population, sampling methods, sample size, instrumentation, and data analysis methods will all be discussed. The current process for an individual to receive care from a U.S. PT usually requires a referral from a health care provider who is considered a gatekeeper. The typical entry point provider is either a MD, DO, PA, or an ARNP who all function as PCMs. Unlike their civilian counterparts, PTs who practice in a DoD medical facility and have completed the required orientation and training, operate under conditions that allow PTs to function as PCMs for MSK patients. Therefore, this study could only occur in a DoD setting because of the breadth of practice privileges that DoD therapists possess. This study is designed to examine possible differences in cost of care and patient satisfaction of patients with MSK pathology between the five PCM groups in the DoD: (a) PTs, (b) MDs, (c) DOs, (d) PAs, and (e) ARNPs. The overarching research question is: Do physical therapists acting in the role of PCM for patients with MSK disorders demonstrate a significant difference in cost compared to how patients with MSK complaints are managed when MDs, DOs, PAs, or ARNPs serve as the PCM?

Hypotheses

This study examined differences in cost of care for MSK patients between the five PCM groups in the DoD: (a) PTs (b) MDs, (c) DOs, (d) PAs and (e) ARNPs. All providers except the PTs have family practice residency training. One participating PT is board certified in orthopedics and the other is board certified in sports by the American Physical Therapy Association. This study examined whether PTs acting in the role of PCM for MSK patients improve management of care compared with the way care is managed when MDs, DOs, PAs or

ARNPs serve as PCMs. This study hypothesizes that different provider disciplines will manage MSK injuries differently, resulting in different costs for health care delivery. Reduced use of imaging studies or prescriptions would result in lower costs. The first null hypothesis for this study was that the management of MSK injury by PT would have the same rate of imaging studies and the same volume of prescription medications as compared to MSK injury management by other disciplines. The second null hypothesis was that the MSK injuries treated by PT would have the same RTW interval as the MSK injuries treated by other disciplines.

The first alternative hypothesis is that PT management of MSK injury will result in a lower rate of imaging studies and a lower volume of prescription medications when compared to MSK injury management of other disciplines. The second alternative hypothesis is that the MSK injuries treated by PT will have an accelerated RTW interval when compared to the MSK injuries managed by other disciplines. The following aims will be tested to determine if PTs functioning as the PCM improve patient care:

Specific Aims

Specific Aim 1

Aim 1 has two parts: (a) to assess differences between groups in the use of imaging for MSK patients by calculating the proportion of initial MSK injury encounters with diagnostic imaging for five different provider types treating multiple MSK injury types and focusing on knee, shoulder and spine; and (b) to calculate the mean diagnostic imaging usage for initial MSK injury encounters for five different provider types.

Specific Aim 2

Aim 2 has two parts: (a) to assess differences between groups in the use of medication for MSK patients by calculating the proportion of initial MSK injury encounters with prescribed

medication for five different provider types; and (b) to calculate the mean prescription medication cost for initial MSK injury encounters for five different provider types based on the average of NSAIDs that are on the MTF pharmacy formulary, using 2016 prices from goodrx.com for Motrin ($12/script), Naprosyn ($9/script), Mobic ($7/script), Celebrex ($35/script), and Etodolac ($47/script).[40]

Specific Aim 3

The two parts of Aim 3 are: (a) to assess differences between groups in RTW intervals for MSK patients by calculating the mean RTW rate for five different provider types treating different MSK injury types; and (b) to calculate the mean RTW interval for initial MSK injury encounters for five different provider types based on 2016 salary estimates from glassdoor.com/Salary/US-Air-Force-Salaries.[40]

Specific Aim 4

Aim 4 of the study was to assess differences between groups for the number of visits involved in treatment before MSK patients return to work by calculating the mean total of associated PT PCM and/or non-PT PCM outpatient visits associated with the total episode of MSK care for the five different PCM types treating patients with MSK disorders. Cost is based on 2015 prices provided by guidedoc.com for various health care provider levels, with the cost of one visit to an MD, DO, PA or ARNP averaged at $200 and the cost of one visit to a PT averaged at $100.[41]

Research Method

This retrospective study of electronic medical records used an exploratory, non-experimental, cross-sectional, and quantitative design. Because the researcher identified associations between variables and also made comparisons between PCM groups, methods

involving both correlational and comparative design were used. Hierarchical linear regressions for non-discreet variables were used to test the hypotheses, and the researcher investigated bi-variate relationships of factors including demographics, treatment, MSK groups, PCM groups, and the dependent variables relating to the cost of care. Correlational methods were used for the comparative element of the study to compare the five PCM groups within the framework of the regressions and correlations.

Study Participants

The retrospective data collection was from an Air Force outpatient orthopedic clinic in which PTs manage patients in a direct access capacity, functioning as the patients' PCM. The PTs work as a team with family practice providers including ARNPs, PAs, MDs and DOs. All patients with MSK complaints who are over the age of 18 and are eligible to receive care at a MTF are afforded the opportunity to be evaluated by the PT through direct-access, same-day care. Patients also have the option to be evaluated by their PCM, which often takes several weeks to occur because of non-PT capacity limitation. Direct access to a PT within the MTF occurs through several avenues, listed below.

1. Direct self-reporting: Notifications at the main MTF entrance inform patients that they can be seen without an appointment or referral from their PCM. Signs posted in the medical group read as follows: "If you have musculoskeletal pain or injury, you can see a physical therapist without seeing your primary care provider. Please come directly to the physical therapy front desk for assistance."
2. Indirect self-reporting: Patients can call the central appointment desk and are triaged by an appointment clerk using the algorithm shown below in Table 1.

3. Traditional reactive model of care: Patients always have the option to see their PCM first before seeing a PT. Patients consent will not be required per IAW 32CFR219.101 (b)(1)(2)(3)(4)(5)(6).

Table 1

Appointment Algorithm

If pain in a muscle or joint with no deformity to the limb	Then	Refer to PT direct access clinic
If pain from a MVA and patient was seen in the ER	Then	Refer to PT direct access clinic
If pain in a muscle or joint in an adolescent 17 or under	Then	Refer to pediatric clinic
If pain with bone deformity	Then	Refer to ER
If the patient has a strain, sprain, or "pulled" muscle	Then	Refer to PT direct access clinic

Exempt Category

Research activities in which the only involvement of human subjects will be in one or more of the following categories may be exempt from the review of the Institutional Review Board (IRB). For a study to be classified as Exempt, it must fit at least one of the categories: IAW 32CFR219.101 (b)(1)(2)(3)(4)(5)(6).

Research involving the collection or study of existing data, documents, records, pathological specimens or diagnostic specimens should be from publicly available sources, or the information must be recorded by the investigator in such a manner that subjects cannot be identified, directly, or through identifiers linked to the subjects. Note that data, documents, records, pathological specimens, or diagnostic specimens must be available at the time of the research proposal, not prospectively.

Patients were not randomized as this study is retrospective and is concerned with examining normal practice flow without assigning patients to the PCM or PT for initial evaluation. Normal patient flow was maintained, ensuring good external validity. The study was designed to assess outcomes of MSK patients who present to either family practice or PT with MSK complaints. Patients with MSK diagnoses who were managed from initial evaluation through discharge by PTs were included. The average patient volume for both the PT and family practice clinics exceeds 50 new MSK patients per month, which provided the minimal number of patients calculated to meet sample size standards of 300 patients.

All patient visits were recorded in AHLTA, and patient outcomes were collected by retrieving patient information from the AHLTA medical records system.

Sample Size

An *a priori* power analysis was conducted to calculate the required sample size for the study. Effect size is the measurement of the strength or magnitude of the relationship between the independent and dependent variables in the analysis.[146] Effect size is usually defined as small, medium, or large, and for this study, the effect size criteria for the linear regressions are defined as small [$f^2 = 0.02$], medium [$f^2 = 0.15$], or large [$f^2 = 0.35$].[146,147]

Based on the literature, a medium effect size was assumed for the study. Alpha level represents the level of significance and corresponds to the probability of a Type I error, which is the probability of rejecting the null hypothesis given that the null hypothesis is true. Usually, the alpha level is set at 0.05 (or a 95% confidence interval).[145] The power of the study represented the probability of being able to reject a false null hypothesis. A power of 80% is usually used for quantitative research.[146]

The sample sizes for the hierarchical linear regression in this study were calculated using G*Power, open-source statistical software that is available online. The settings used to determine the sample size for the linear regression analyses were power = 0.80, effect size (f^2 (v) = 0.15) and alpha for the level of significance = 0.05, and 27 variables. A total of 300 records was needed to sufficiently power the study for the hierarchical linear regression models, using forward stepwise estimation technique.

Data Collection

Collection of patient data was processed through Air Force Medical Service Analytics, through a retrieval of patient information from the AHLTA medical records systems. Demographic data for each patient included the following: age in years, gender, ethnicity, marital status. Patient characteristic variables included: tobacco use, alcohol use, body mass index, and pain. Coded indicator variables were used to classify each patient's PCM group and MSK site of injury. Dependent variables included all imaging ordered, NSAID prescription rate, and the number of patient visits until RTW. Table 2 below presents the operationalization of the study variables.

Table 2

Operationalization of Study Variables

Variable Type/Name	Description	Classification	Operationalization
Dependent variables			
Imaging use	Indicates if the patient had imaging	Dichotomous	1 = Yes 0 = No
Medication Use	If the patient used medication	Dichotomous	1 = Yes 0 = No
Number of Visits	A measure of the actual number of PT or PCM visits for the patient	Frequency count	Number of visits
Independent control variables			
Patient age	Age	Continuous	0 = 18-24yrs 1 = 25-34yrs 2 = 34-44yrs 3 = 45-64yrs 4 = 65+
Patient gender	Gender	Dichotomous	0 = Male 1 = Female
Patient marital status	The marital status of the patient	Dichotomous	0 = Married 1 = Single
Ethnicity=White	Patients classified as White ethnicity	Ordinal	1
Ethnicity=Black	Patients classified as Black ethnicity	Ordinal	2
Ethnicity=Hispanic	Patients classified as Hispanic ethnicity	Ordinal	3
Ethnicity=Asian	Patients classified as Asian ethnicity	Ordinal	4
Ethnicity= other non-white	Patients classified as other/non-white ethnicity	Ordinal	5

(Continued on next page)

Variable Type Name	Description	Classification	Operationalization
Tobacco use	If the patient uses tobacco	Dichotomous	1 = Yes 0 = No
Alcohol use	If the patient uses alcohol	Dichotomous	1 = Yes 0 = No
BMI	Patient's body mass index	Continuous	Calculated from height and weight measures using the formula: (weight in kilograms) ÷ (height in centimeters)^2
Pain scale	Indicates the level of pain a patient feels	Ordinal	Scored on a scale of 0 – 10: 0 = No pain 10 = Intense pain
Referral to PCM	Indicates if the patient had a referral to a PCM other than PT	Dichotomous	1 = Yes 0 = No
MSK = spine	The patient presented with spine pain	Dichotomous	1 = Yes 0 = No
MSK = shoulder	The patient presented with shoulder pain	Dichotomous	1 = Yes 0 = No
MSK = knee	The patient presented with knee pain	Dichotomous	1 = Yes 0 = No

(Continued on next page)

Variable Type Name	Description	Classification	Operationalization
MSK = ankle	The patient presented with ankle pain	Dichotomous	1 = Yes 0 = No
MSK = other	The patient presented with MSK pain other than spine, shoulder, knee, or ankle	Dichotomous	1 = Yes 0 = No
Independent variables			
PCM = PT	The patient's primary care manager type was a physical therapist (PT)	Dichotomous	1 = Yes 0 = No
PCM = MD	The patient's primary care manager type was a medical doctor (MD)	Dichotomous	1 = Yes 0 = No
PCM = DO	The patient's primary care manager type was a doctor of osteopathic medicine (DO)	Dichotomous	1 = Yes 0 = No
PCM = PA	The patient's primary care manager type was a physician assistant	Dichotomous	1 = Yes 0 = No
PCM = ARNP	The patient's primary care manager type was a ARNP	Dichotomous	1 = Yes 0 = No

Notes. Body mass index (BMI); **p**hysical therapy (PT); primary care manager (PCM) musculoskeletal (MSK); medical doctor (MD); Doctor of Osteopathic Medicine (DO); physician assistant (PA); advanced registered nurse practitioner (ARNP)

Validity and Reliability

AHLTA has been used in all DoD facilities since 2006,[143] serving as a repository for patient data. Treatment and appropriateness of treatment are not related to AHLTA patient data storage.

Data Analysis

All data was analyzed with IBM©SPSS® Statistics Version 22. The data was plotted to assess distribution, and non-parametric techniques were used if data was not normally distributed. A socio demographic profile was created to describe the study population.

Study aim 1a. Diagnostic imaging use for patients with MSK disorders was compared among the five provider groups using proportion estimation.

Study aim 1b. The mean cost of diagnostic imaging was compared across the five provider groups using analysis of variance (AoV).

Study aim 2a. NSAIDS prescribed for patients with MSK disorders was compared across the five provider groups using proportion estimation.

Study aim 2b. The mean cost of NSAIDS prescribed by each of the five provider groups for patients with MSK disorders was to the mean cost medications prescribed by the other groups using AoV.

Study aim 3a. Number of visits **f**or patients with MSK conditions was compared among the five provider groups using proportion estimation.

Study aim 4a. The mean number of visits for patients with MSK disorders was compared across the five provider groups using AoV.

Hierarchical cost regression models were made according to the variable list in Table 2 – that is, costs of MSK treatment were regressed on socio demographic variables, and the study variables were subjected to descriptive statistics to report proportions with a 95% confidence interval, means with standard deviation, and projected costs. Cost of care regarding prescription use was calculated based on the number of NSAID scripts.

The sample sizes for the hierarchical linear regression in this study were calculated using G*Power, an open-source, statistical software package available online. The settings used to determine the sample size for the linear regression analyses were power = 0.80, effect size (f^2 (v) = 0.15) and alpha for the level of significance = 0.05, and a total of 25 variables. A total of 300 records was needed to sufficiently power the study for the hierarchical linear regression models,

using forward stepwise estimation technique. Table 3 below presents the operationalization of the study variables.

Table 3

Model Specifications for the Hierarchical Regressions

Step	Variable Name
Step 1 – Demographic controls	
	Patient age
	Patient gender
	Patient marital status
	Patient ethnicity – Black
	Patient ethnicity – Hispanic
	Patient ethnicity – Asian
	Patient ethnicity – Other/Non-White
Step 2 – Patient characteristics and comorbidities	
	Tobacco use
	Alcohol use
	BMI
	Pain
	MSK = shoulder
	MSK = knee
	MSK = spine
	MSK = other
Step 3 – PCM	
	PCM = MD
	PCM = DO
	PCM = PA
	PCM = ARNP
	PCM = PT

Notes. Reference group for gender = Male; Reference group for Ethnicity = White; Reference group for MSK = Spine; Reference group for PCM = PT; Reference group for referral = none.

Body mass index (BMI); **p**hysical therapy (PT); primary care manager (PCM); musculoskeletal (MSK); medical doctor (MD); Doctor of Osteopathic Medicine (DO); physician assistant (PA); advanced Registered nurse practitioner (ARNP)

Timeline

A constructive framework for the study followed the dates listed below.

1. Submit dissertation idea paper/IRB process : Jan. 1, 2016.
2. Submit overview/literature review/methods (Chapters 1-3): Oct. 1, 2016
3. Collect data (back two years): March 1, 2017.
4. Perform data analysis (Chapter 4): April 1, 2017.
5. Submit final dissertation report (Chapters 1-5, references and appendices): Dec 20, 2017.

Limitations and Delimitations

Some limitations may have threatened the validity of the findings of this study, including selection bias, misclassification, residual confounding, and error. The data were cross-sectional and highlight associations, but causality between the independent and dependent variables could not be inferred since an experimental design was not used. The data may have been subject to recall and reporting biases because information was are based on PCM reporting into the patient records.

Although the outcome measures were well-defined, there was no reported data on the reliability and validity of the measures. Potential confounders may not have been included in the study design – other cost of care areas that were not able to be examined due to the breadth of study, for example. A final limitation of this study was the 18-month timeframe.

This study was conducted in a single military facility. The results may not be generalizable to any other military facilities, as methods, modes of referral, and patient management may differ among facilities. Results may be unique to these patients only due to the specific mission requirements of the base location. Because the setting is military, and military physical therapists must complete an orientation, compliance training, and other training related to being able to order imaging and NSAIDS before they can serve as PCMs, the findings may not

be generalizable to the civilian population. Although the APTA states that DPT education should prepare graduates to be able to order appropriate imaging and prescribe medicine, the reality of curriculum content may not be consistent with these skills.

Limitations

The design of questions and tests of hypotheses was dependent on the availability of data from the ALHTA system. Inconsistencies in data entry may have been present in the patient records, and material for conducting cross-checks of the data was not available to the researcher.

There may have been indicators of costs of care or patient satisfaction that were overlooked or not addressed in the study, since using 25 independent variables does not allow for every possible item associated with the cost of care to be examined. Further conceptual and empirical work is needed to clarify what constitutes the cost of care and patient satisfaction variables.

Summary

The DoD is a unique medical practice environment. Medical practitioners are often credentialed to practice in ways that civilian practitioners are not. Practice within the DoD provides PTs with increased practice privileges compared to the practice privileges of PTs practicing in the private sector. This study examined the effectiveness of therapists who are permitted to practice the complete range of their skill sets, and compare their effectiveness to that of other PCMs. Current doctoral PT programs offer the needed requirements for graduates to practice skills such as ordering imaging studies, medications, and laboratory tests. The issue is that state practice acts and pressure from other medical groups have been successful in restricting PTs from full use of the skills learned during DPT educational programs. [145,146]

Chapter 4: Results and Analysis

The purpose of exploratory, retrospective, non-experimental, cross-sectional, quantitative study was to determine associations between variables as well as make comparisons between PCM groups in order to examine the cost of PTs serving in the role of PCM. The study examined differences in cost of care and RTW rates for patients with MSK disorders whose care was managed between the five PCM groups in the Air Force: (a) physical therapists, (b) medical doctors, (c) doctors of osteopathic medicine, (d) physician assistants, and (e) advanced registered nurse practitioners (ARNPs). Chapter four presents the summaries of the descriptive data, of the data analysis using ANOVA, and of the hierarchical linear regression analysis. The researcher used IBM©SPSS® Statistics Version 22 to conduct the data analysis. The overarching research question and hypotheses guiding this study was the following:

RQ: Do physical therapists acting in the role of PCMs for patients with MSK disorders demonstrate a significant difference in cost compared MDs, DOs, PAs, or ARNPs serving in the role as PCM for patients with MSK disorders?

The hypotheses for this study were as follows:

$H0_1$: Management of MSK patients by PTs serving as the PCM will have the same rate of imaging studies when compared to the management of MSK patients by MDs, DOs, PAs, or ARNPs serving as the PCM.

Ha_1: PT management of patients with MSK disorders will result in a lower rate of imaging studies when MD, DO, PA, or ARNP management of patients with MSK disorders.

$H0_2$: PT management of patients with MSK disorders will result in the same rate of NSAIDS usage as MD, DO, PA, or ARNP management of patients with MSK disorders.

Ha_2: PT management of patients with MSK disorders will result in a lower rate of NSAIDS usage when compared to MD, DO, PA, or ARNP management of patients with MSK disorders.

$H0_3$: Patients with MSK disorders managed by PTs will have the same number of visits as patients with MSK disorders managed by MDs, DOs, PAs, or ARNPs.

Ha_3: Patients with MSK disorders managed by PTs will have less visits when compared to patients with MSK disorders managed by MDs, DOs, PAs, or ARNPs.

$H0_4$: Patients with MSK disorders managed by PTs will have the same cost compared to patients with MSK disorders managed by MDs, DOs, PAs, or ARNPs.

Ha_4: Patients with MSK disorders managed by PTs will demonstrate lower care cost compared to patients with MSK disorders managed by MDs, DOs, PAs, or ARNPs.

Summaries of demographic data

The samples consisted of 8,053 patients with MSK disorders who sought care at a military medical clinic during the 18-month period from Jan 2016 to June 2017. Demographic data included age, gender, occupation, comorbidities, pain rating at initial visit, body part injured, and time from start of treatment to return to work. The summaries of the demographic data for the 8,053 patients and data of the independent variables are shown in Tables 1 and 2, and listed below.

- Age: Patients ranged in age from 18 to 65 years old, with 1,449 patients (18%) between 18 and 24 years of age; with 2,662 patients (33.1%) between the ages of 25 and 34 years old; with 2,064 patients (25.6%) between 34 and 44 years of age, with 1,684 patients (20.9%) between the ages of 45 and 64, and 194 of the patients (2.4%) aged 65 or over. The mean age of participating patients was 36.10 years old (SD = 12.63).
- Gender: More than half of the patients (5,290, 65.7%) were male, and 2,763 of them (34.3%) were female. (5,290; 65.7%).
- Marital status: Nearly a third of patients (2,565, 31.9%) were listed as married, while 1,176 patients (14.6%) were listed as single, and 53.5% of patients did not report their marital status.
- Ethnicity: A total of 3,852 patients (35.1%) reported their ethnicity as white, while 1,709 (21.2%) of patients reported their ethnicity as non-white.
- For patient, most were senior enlisted (4,039, 50.2%) and junior enlisted (3,467; 43.1%).
- Evaluator groups: Five medical doctors evaluated the largest proportion of patients (3,592, 44.5%), with physician assistants evaluating 1,962 patients (24.4%), and two physical therapists evaluating between them the smallest group of patients (1,781; 22.1%).
- BMI: The BMI range of the 8,053 patients ranged from 14.93 to 55.05, with the mean BMI being 28.45 (SD = 4.59).

- Tobacco and alcohol use: Only 523 (6.5%) out of the 8,053 patients reported tobacco use, while more than half of the 8,053 patients reported that they used alcohol (4,652; 57.8%).
- Injury: One hundred eleven (1.4%) of the patients were seen for spine pain, 849 of them (10.5%) presented with shoulder pain, 1,543 of the patients (19.2%) presented with knee pain, 601 of them (7.5%) presented with ankle pain, and more than half of the patients (4,943, 61.4%) presented with MSK pain other than spine, shoulder, knee, or ankle.

Table 4

Frequency and Percentage Summaries of Categorical Measured Demographic Data and Data of Independent Variables

	Frequency	Percent
Age Category		
18-24	1449	18.0
25-34	2662	33.1
34-44	2064	25.6
45-64	1684	20.9
65+	194	2.4
Gender		
Male	5290	65.7
Female	2763	34.3
Marital Status		
Married	2565	31.9
Single	1176	14.6
Missing	4312	53.5
Ethnicity		
White	2707	33.6
Black	343	4.3

(Continued on next page)

	Frequency	Percent
Hispanic	17	0.2
Asian	165	2.0
Other non-White	1709	21.2
Patient Income (Sponsor Rank Group)		
1.0 Junior enlisted	3467	43.1
2.0 Senior enlisted	4039	50.2
3.0 Junior officer	223	2.8
4.0 Senior officer	317	3.9
Missing	7	0.1
Tobacco Use		
No	5544	68.8
Yes	523	6.5
Missing	1986	24.7
Alcohol		
No	2989	37.1
Yes	4652	57.8
Missing	412	5.1
Pain		
Missing	466	5.8
#MULTIVALUE 1-8	5926	73.6
0 No pain	831	10.3
1	37	0.5
2	15	0.2
3	109	1.4
4	131	1.6
5	104	1.3
6	171	2.1
7	105	1.3
8	55	0.7
9	59	0.7
10 Intense pain	44	0.5

(Continued on next page)

	Frequency	Percent
MSK (Spine)		
No	7942	98.6
Yes	111	1.4
MSK (Shoulder)		
No	7204	89.5
Yes	849	10.5
MSK (Knee)		
No	6504	80.8
Yes	1549	19.2
MSK (Ankle)		
No	7452	92.5
Yes	601	7.5
MSK (Other)		
No	3110	38.6
Yes	4943	61.4
Specialty		
Physical Therapist	1781	22.1
Medical Doctor	3582	44.5
Doctor of Osteopathic Medicine	145	1.8
Physician Assistant	1962	24.4
Advanced Registered Nurse practitioner	583	7.2

Note. Musculoskeletal (MSK)

Table 5

Descriptive Statistics Summaries of Continuous Measured Demographic Data

	N	Minimum	Maximum	Mean	Std. Deviation
Age	8053	18.00	65.00	35.43	12.67
Body mass index	8007	14.93	55.05	28.83	4.59

Summaries of Data of Dependent Variables

The summaries of the data of the dependent variables are shown in Table 3. The dependent variables include the imaging use, number of visits until RTW, different cost of care to include medication and cost of visits dependent on PCM type.

Imaging values for patients during the episode of care ranged from 0 (if no imaging was ordered) to 56 images ordered, with a mean of 3.57 images ordered (SD = 2.96). Number of visits, as measured by individual patient encounters, ranged from one visit to 10 visits, with a mean of 1.23 visits (SD = 0.81). The ranges of values of the mean diagnostic imaging cost for initial MSK injury encounter for the 8,053 patients was from $59.00 to $116.33, while the mean was $64.50 (SD = $11.61). If a radiology study was not ordered, no cost was associated with the visit. Cost of prescribed anti-inflammatory medications ranged in values from $0.00 cost (when no medication was prescribed) to $37.00. The mean was $22.00 (SD = $). The range of cost per episode care, based on the number of patient visits, ranged from $100 to $2,000, and the mean was $222.30 (SD = $163.26).

Table 6

Descriptive Statistics Summaries of Continuous Measured Dependent Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Imaging Use (number of radiology exams ordered)	4225	0.0	56.00	3.57	2.96
Number of visits for RTW rates (encounters)	8053	1.0	10.00	1.23	0.81
Mean diagnostic imaging cost	2438	0.0	116.33	20.11	30.59
Medication use cost	2509	0.0	37.00	22.00	30.01
Cost of visit	8053	100.0	2000.00	213.30	144.20

NOTE: Return to Work (RTW).

Results of ANOVA of Differences in Care for MSK patients among different PCM groups

ANOVA was conducted to determine differences in the care for MSK patients between the five PCM groups represented in this military medical group: (a) PTs, (b) MDs, (c) DOs, (d) PAs, and (e) ARNPs. A level of significance of 0.05 was used in the ANOVA. The ANOVA results are presented in Table 4.

One-way ANOVA results in Table 4 showed that the imaging use (F[4, 1293] = 1.140, p < 0.336), medication use (F[4, 2433] = 146.53, p < 0.001), number of visits or RTW rates (F[4, 2504] = 6.153, p < 0.000), mean diagnostic imaging cost (F[4, 2504] = 134.994, p = 0.02), medication use cost (F[4, 2504] = 49.191, p < 0.001), and cost of visits (F[4, 2504] = 49.191 p < 0.000) of MSK patients were significantly different except for imaging use (p < 0.336), which depended on the PCM managing their care.

Post hoc tests were performed for these results to further analyze the significant differences, and these tests are presented in Table 5. For imaging use, it can be observed that PAs and ARNPs acting as PCMs ordered a significantly greater number of imaging studies than the PTs acting as PCMs. PTs ordered the least amount of radiology studies when compared to MDs or DOs as well, by mean differences of -0.10, .42 and 0.54, respectively.

For medication use, PTs prescribed significantly less medication (fewer NSAIDs) than MDs, DOs, PAs, and ARNPs by mean differences of –16.1133, -9.9057, -13.8669, and -12.6703, respectively. Patients with MSK disorders when MDs served as PCMs had a significantly greater number of medications prescribed than patients with MSK disorders of when PAs, ARNPs and PTs acted as PCMs, by mean differences of 2.24, 3.44, and 9.90 respectively.

For number of visits or RTW rates, MSK patients with MD PCMs had a significantly greater number of visits before returning to work than MSK patients with PT PCMs, by a mean

difference of 0.173.

For mean diagnostic imaging cost for patients with MSK disorders, patients of ARNPs acting as PCMs had a significantly greater mean diagnostic imaging cost than patients of MDs acting as PCMs, by a mean difference of 2.92

For medication use cost, it was observed that PTs were the PCMs for MSK patients, they had significant lower costs associated with NSAID prescriptions than when MDs, DOs, PAs, and ARNPs were the PCMs for MSK patients, by mean differences of -337.78, -203.58, -300.51, -262.01 respectively. Patients with MSK disorders managed by MD PCMs had a significantly greater medication use cost than patients with MSK disorders managed by PT PCMs and ARNP PCMs, by mean differences of 337.78 and 75.76 respectively.

For costs of visits, patients with MSK disorders who had PTs serving as their PCMs have a significantly lower visit cost than patients with MSK disorders who had MDs, PAs, and ARNPs serving as their PCMs, by mean differences of -106.56, -100.62, and -99.53 respectively.

Table 7

ANOVA Results of Differences of Imaging Use, Medication Use, and Numbers of Visits or RTW Rates by PCM Type

		Sum of squares	df	Mean square	F	Sig.
Number of Services of Record	Between Groups	37.674	4	9.418	1.140	.336
	Within Groups	10683.655	1293	8.263		
	Total	10721.328	1297			
Number of Scripts	Between Groups	103719.729	4	25929.932	146.534	.001
	Within Groups	430532.907	2433	176.956		
	Total	534252.637	2437			
Encounters	Between Groups	18.971	4	4.743	6.153	.001
	Within Groups	1930.112	2504	.771		
	Total	1949.083	2508			
Mean diagnostic imaging cost	Between Groups	1975.987	4	493.997	3.677	.005
	Within Groups	336414.548	2504	134.351		
	Total	338390.535	2508			
Medication Use Cost	Between Groups	46700336.054	4	11675084.013	134.994	.001
	Within Groups	216560368.791	2504	86485.770		
	Total	263260704.845	2508			
Cost of Visit	Between Groups	4870761.105	4	1217690.276	49.191	.001
	Within Groups	61984870.621	2504	24754.341		
	Total	66855631.726	2508			

Table 8

Post-Hoc Results Using Tukey's Statistics of Differences of Imaging Use, Medication Use, and Numbers of Visits or RTW Rates by PCM Types

Dependent Variable	(I) Specialty	(J) Specialty	Mean Diff.(I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Number of imaging orders	1.0 Physical therapist	2.0 Medical doctor	.1070	.2015	.984	-.443	.657
		3.0 Doctor of osteopathic medicine	.2776	.5881	.990	-1.329	1.884
		4.0 Physician assistant	.4257	.2501	.433	-.257	1.109
		5.0 Nurse practitioner	.5428	.3699	.584	-.468	1.553
	2.0 Medical doctor	1.0 Physical therapist	-.1070	.2015	.984	-.657	.443
		3.0 Doctor of osteopathic medicine	.1706	.5747	.998	-1.399	1.740
		4.0 Physician assistant	.3187	.2166	.581	-.273	.910
		5.0 Nurse practitioner	.4358	.3481	.721	-.515	1.387
	3.0 Doctor of osteopathic medicine	1.0 Physical therapist	-.2776	.5881	.990	-1.884	1.329
		2.0 Medical doctor	-.1706	.5747	.998	-1.740	1.399
		4.0 Physician assistant	.1481	.5935	.999	-1.473	1.769
		5.0 Nurse practitioner	.2652	.6531	.994	-1.519	2.049
	4.0 Physician assistant	1.0 Physical therapist	-.4257	.2501	.433	-1.109	.257
		2.0 Medical doctor	-.3187	.2166	.581	-.910	.273
		3.0 Doctor of osteopathic medicine	-.1481	.5935	.999	-1.769	1.473
		5.0 Nurse practitioner	.1171	.3783	.998	-.916	1.151

Dep. Var.	(I) Specialty	(J)Specialty	Mean Diff.(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
	5.0 Advanced registered nurse practitioner	1.0 Physical therapist	-.5428	.3699	.584	-1.553	.468
		2.0 Medical doctor	-.4358	.3481	.721	-1.387	.515
		3.0 Doctor of osteopathic medicine	-.2652	.6531	.994	-2.049	1.519
		4.0 Physician assistant	-.1171	.3783	.998	-1.151	.916
Number of scripts	1.0 Physical therapist	2.0 Medical doctor	-16.1133*	.6831	.001	-17.978	-14.248
		3.0 Doctor of osteopathic medicine	-9.9057*	2.3804	.001	-16.404	-3.408
		4.0 Physician assistant	-13.8669*	.7759	.001	-15.985	-11.749
		5.0 Nurse practitioner	-12.6703*	1.2486	.001	-16.079	-9.262
	2.0 Medical doctor	1.0 Physical therapist	16.1133*	.6831	.001	14.248	17.978
		3.0 Doctor of osteopathic medicine	6.2076	2.3505	.063	-.209	12.624
		4.0 Physician assistant	2.2464*	.6786	.008	.394	4.099
		5.0 Nurse practitioner	3.4430*	1.1906	.032	.193	6.693
	3.0 Doctor of osteopathic medicine	1.0 Physical therapist	9.9057*	2.3804	.001	3.408	16.404
		2.0 Medical doctor	-6.2076	2.3505	.063	-12.624	.209
		4.0 Physician assistant	-3.9613	2.3791	.456	-10.456	2.533
		5.0 Nurse practitioner	-2.7647	2.5724	.820	-9.787	4.258
	4.0 Physician assistant	1.0 Physical therapist	13.8669*	.7759	.001	11.749	15.985
		2.0 Medical doctor	-2.2464*	.6786	.008	-4.099	-.394
		3.0 Doctor of osteopathic medicine	3.9613	2.3791	.456	-2.533	10.456
		5.0 Nurse practitioner	1.1966	1.2462	.873	-2.205	4.598

	(I)Specialty	(J)Specialty	Mean Diff.(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
	5.0 Advanced registered nurse practitioner	1.0 Physical therapist	12.6703*	1.2486	.001	9.262	16.079
		2.0 Medical doctor	-3.4430*	1.1906	.032	-6.693	-.193
		3.0 Doctor of osteopathic medicine	2.7647	2.5724	.820	-4.258	9.787
		4.0 Physician assistant	-1.1966	1.2462	.873	-4.598	2.205
Encounters	1.0 Physical therapist	2.0 Medical doctor	.1732*	.0447	.001	.051	.295
		3.0 Doctor of osteopathic medicine	.4027	.1528	.064	-.014	.820
		4.0 Physician assistant	.2124*	.0510	.001	.073	.352
		5.0 Nurse practitioner	.2179	.0804	.053	-.002	.437
	2.0 Medical doctor	1.0 Physical therapist	-.1732*	.0447	.001	-.295	-.051
		3.0 Doctor of osteopathic medicine	.2295	.1507	.547	-.182	.641
		4.0 Physician assistant	.0392	.0442	.902	-.081	.160
		5.0 Nurse practitioner	.0448	.0763	.977	-.163	.253
	3.0 Doctor of osteopathic medicine	1.0 Physical therapist	-.4027	.1528	.064	-.820	.014
		2.0 Medical doctor	-.2295	.1507	.547	-.641	.182
		4.0 Physician assistant	-.1903	.1526	.724	-.607	.226
		5.0 Nurse practitioner	-.1848	.1648	.795	-.635	.265
	4.0 Physician assistant	1.0 Physical therapist	-.2124*	.0510	.001	-.352	-.073
		2.0 Medical doctor	-.0392	.0442	.902	-.160	.081
		3.0 Doctor of osteopathic medicine	.1903	.1526	.724	-.226	.607
		5.0 Nurse practitioner	.0056	.0801	1.000	-.213	.224

Dep. Var.	(I) Specialty	(J) Specialty	Mean Diff.(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
	5.0 Advanced registered nurse practitioner	1.0 Physical therapist	-.2179	.0804	.053	-.437	.002
		2.0 Medical doctor	-.0448	.0763	.977	-.253	.163
		3.0 Doctor of osteopathic medicine	.1848	.1648	.795	-.265	.635
		4.0 Physician assistant	-.0056	.0801	1.000	-.224	.213
Mean diagnostic imaging cost	1.0 Physical therapist	2.0 Medical doctor	1.55561	.59059	.065	-.0566	3.1678
		3.0 Doctor of osteopathic medicine	-.83756	2.01729	.994	-6.3443	4.6692
		4.0 Physician assistant	1.37957	.67353	.243	-.4590	3.2182
		5.0 Nurse practitioner	-1.37375	1.06137	.695	-4.2710	1.5236
	2.0 Medical doctor	1.0 Physical therapist	-1.55561	.59059	.065	-3.1678	.0566
		3.0 Doctor of osteopathic medicine	-2.39317	1.98911	.750	-7.8230	3.0366
		4.0 Physician assistant	-.17605	.58375	.998	-1.7695	1.4174
		5.0 Nurse practitioner	-2.92936*	1.00679	.030	-5.6777	-.1811
	3.0 Doctor of osteopathic medicine	1.0 Physical therapist	.83756	2.01729	.994	-4.6692	6.3443
		2.0 Medical doctor	2.39317	1.98911	.750	-3.0366	7.8230
		4.0 Physician assistant	2.21712	2.01529	.807	-3.2841	7.7184
		5.0 Nurse practitioner	-.53619	2.17584	.999	-6.4757	5.4033
	4.0 Physician assistant	1.0 Physical therapist	-1.37957	.67353	.243	-3.2182	.4590
		2.0 Medical doctor	.17605	.58375	.998	-1.4174	1.7695
		3.0 Doctor of osteopathic medicine	-2.21712	2.01529	.807	-7.7184	3.2841
		5.0 Nurse practitioner	-2.75331	1.05758	.070	-5.6403	.1336

Dep. Var.	(I) Specialty	(J) Specialty	Mean Diff.(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
	5.0 Advanced registered nurse practitioner	1.0 Physical therapist	1.37375	1.06137	.695	-1.5236	4.2710
		2.0 Medical doctor	2.92936*	1.00679	.030	.1811	5.6777
		3.0 Doctor of osteopathic medicine	.53619	2.17584	.999	-5.4033	6.4757
		4.0 Physician assistant	2.75331	1.05758	.070	-.1336	5.6403
Medication Use Cost	1.0 Physical therapist	2.0 Medical doctor	-337.7857*	14.9844	.001	-378.690	-296.882
		3.0 Doctor of osteopathic medicine	-203.5815*	51.1823	.001	-343.297	-63.866
		4.0 Physician assistant	-300.5181*	17.0888	.001	-347.166	-253.870
		5.0 Nurse practitioner	-262.0177*	26.9290	.001	-335.528	-188.508
	2.0 Medical doctor	1.0 Physical therapist	337.7857*	14.9844	.001	296.882	378.690
		3.0 Doctor of osteopathic medicine	134.2041	50.4673	.060	-3.560	271.968
		4.0 Physician assistant	37.2676	14.8107	.087	-3.162	77.697
		5.0 Nurse practitioner	75.7679*	25.5441	.025	6.038	145.497
	3.0 Doctor of osteopathic medicine	1.0 Physical therapist	203.5815*	51.1823	.001	63.866	343.297
		2.0 Medical doctor	-134.2041	50.4673	.060	-271.968	3.560
		4.0 Physician assistant	-96.9366	51.1317	.320	-236.514	42.641
		5.0 Nurse practitioner	-58.4362	55.2050	.828	-209.133	92.260

Dep Var.	(I) Specialty	(J) Specialty	Mean Diff.(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
	4.0 Physician assistant	1.0 Physical therapist	300.5181*	17.0888	.001	253.870	347.166
		2.0 Medical doctor	-37.2676	14.8107	.087	-77.697	3.162
		3.0 Doctor of osteopathic medicine	96.9366	51.1317	.320	-42.641	236.514
		5.0 Nurse practitioner	38.5004	26.8328	.605	-34.747	111.748
	5.0 Advanced registered nurse practitioner	1.0 Physical therapist	262.0177*	26.9290	.001	188.508	335.528
		2.0 Medical doctor	-75.7679*	25.5441	.025	-145.497	-6.038
		3.0 Doctor of osteopathic medicine	58.4362	55.2050	.828	-92.260	209.133
		4.0 Physician assistant	-38.5004	26.8328	.605	-111.748	34.747
Cost of Visit	1.0 Physical therapist	2.0 Medical doctor	-106.5656*	8.0166	.001	-128.449	-84.682
		3.0 Doctor of osteopathic medicine	-51.1586	27.3825	.335	-125.906	23.589
		4.0 Physician assistant	-100.6539*	9.1425	.001	-125.611	-75.697
		5.0 Nurse practitioner	-99.5395*	14.4070	.001	-138.867	-60.212
	2.0 Medical doctor	1.0 Physical therapist	106.5656*	8.0166	.001	84.682	128.449
		3.0 Doctor of osteopathic medicine	55.4070	27.0000	.242	-18.297	129.111
		4.0 Physician assistant	5.9116	7.9237	.946	-15.718	27.542
		5.0 Nurse practitioner	7.0260	13.6661	.986	-30.279	44.331

Dep. Var.	(I) Specialty	(J) Specialty	Mean Diff.(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
	3.0 Doctor of osteopathic medicine	1.0 Physical therapist	51.1586	27.3825	.335	-23.589	125.906
		2.0 Medical doctor	-55.4070	27.0000	.242	-129.111	18.297
		4.0 Physician assistant	-49.4954	27.3554	.368	-124.169	25.178
		5.0 Nurse practitioner	-48.3810	29.5347	.473	-129.004	32.242
	4.0 Physician assistant	1.0 Physical therapist	100.6539*	9.1425	.001	75.697	125.611
		2.0 Medical doctor	-5.9116	7.9237	.946	-27.542	15.718
		3.0 Doctor of osteopathic medicine	49.4954	27.3554	.368	-25.178	124.169
		5.0 Nurse practitioner	1.1144	14.3555	1.000	-38.073	40.302
	5.0 Advanced registered nurse practitioner	1.0 Physical therapist	99.5395*	14.4070	.001	60.212	138.867
		2.0 Medical doctor	-7.0260	13.6661	.986	-44.331	30.279
		3.0 Doctor of osteopathic medicine	48.3810	29.5347	.473	-32.242	129.004
		4.0 Physician assistant	-1.1144	14.3555	1.000	-40.302	38.073

*. The mean difference is significant at the 0.05 level.

Hierarchical Linear Regression Results

Hierarchical linear regressions were conducted to determine associations between variables, specifically to test the hypothesis that PTs are more effective PCMs for patients with MSK disorders than non-PT PCMs. The hierarchical linear regression analysis determined the bi-variate relationships between the factors of the demographic factors, comorbidity, treatment, MSK groups, PCM groups, and the dependent variables relating to the cost of care. There were six dependent variables in the study, including imaging use, medication use, mean diagnostic imaging cost, medical use cost, and cost of visit. Costs of care regarding prescriptions use were calculated based on the number of scripts written, NSAID use, and the patient's type of injury.

Different hierarchical linear regression models were created for each of these dependent variables. In the hierarchical linear regression models, the demographic data, patient characteristics and comorbidities were first controlled prior to determining the effects of the PCM types on the different dependent variables. It should be taken into consideration that referral status was not included as an independent variable since this data was not available.

First, Table 9 summarizes the results of the hierarchical linear regression to determine the individual effects of the demographics, patient characteristics, comorbidities, and PCM types on imaging use of MSK patients. The regression results showed that the regression model was (F[4, 1293] = 1.140, $p < 0.336$). SPSS was not able to create a regression with acceptable model fit. The combined effect size of the different independent and control variables on the dependent variable of imaging use was small.[142] The different independent and control variables captured 11% of the variance of imaging use. Prior to controlling for the effects of the listed variables, investigation of the significance of their individual effects showed that patient's ethnicity of black (t[1283] = 3.578, $p < 0.01$), alcohol use (t[1283] = 2.891, $p < 0.004$), and BMI (t[1283] = -2.45 $p < 0.014$) had significant effects on imaging use. Conversely, after controlling for demographics, patient characteristics and comorbidities, it was determined that if the MSK patient's PCM type was PT, there was a (t[1283] = 2.12, $p < .034$ significant effect on the imaging use of the patients with MSK disorders.

Table 9

Hierarchical Linear Regression Results of Effects of PCM Types on Imaging Use While Controlling Demographic and Patient Comorbidities

Model		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
		B	Std. error	Beta	t	Sig.
1	(Constant)	1.003	1.020		.983	.326
	Age category	.011	.149	.004	.074	.941
	Gender	.302	.335	.049	.901	.368
	Marital status	.352	.389	.058	.904	.367
	Ethnicity (white)	1.569	.928	.272	1.691	.092
	Ethnicity (black)	2.808	.785	.177	3.578	.000*
	Ethnicity (Hispanic)	-.047	2.222	-.001	-.021	.983
	Ethnicity (Asian)	-.038	1.151	-.003	-.033	.974
	Ethnicity (other non-white)	1.312	.949	.222	1.383	.167
	Patient income (sponsor rank group)	.341	.224	.088	1.523	.128
2	(Constant)	3.023	1.420		2.129	.034
	Age category	.109	.154	.040	.711	.477
	Gender	.235	.335	.038	.702	.483
	Marital status	.464	.385	.076	1.206	.228
	Ethnicity (white)	2.022	.933	.351	2.168	.031*
	Ethnicity (black)	2.533	.778	.160	3.256	.001*
	Ethnicity (Hispanic)	.906	2.326	.022	.389	.697
	Ethnicity (Asian)	.207	1.171	.015	.177	.860
	Ethnicity (other non-white)	1.640	.956	.277	1.716	.087
	Patient income (sponsor rank group)	.250	.227	.065	1.101	.271
	Tobacco use	-.551	.508	-.064	-1.084	.279
	Alcohol	.833	.288	.145	2.891	.004*
	Body mass index	-.085	.035	-.126	-2.475	.014*
	MSK (spine)	-1.259	.813	-.082	-1.549	.122
	MSK (shoulder)	-.587	.310	-.096	-1.894	.059

(Continued on next page)

Model		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
		B	Std. Error	Beta	t	Sig.
3	(Constant)	2.531	1.486		1.703	.089
	Age category	.217	.156	.080	1.386	.167
	Gender	.402	.343	.065	1.173	.241
	Marital status	.664	.395	.109	1.679	.094
	Ethnicity (white)	2.240	.940	.388	2.384	.018*
	Ethnicity (black)	2.550	.776	.161	3.285	.001*
	Ethnicity (Hispanic)	1.216	2.361	.029	.515	.607
	Ethnicity (Asian)	.304	1.180	.022	.258	.797
	Ethnicity (other non-white)	1.795	.958	.304	1.874	.062
	Patient income (sponsor rank group)	.319	.228	.083	1.399	.162
	Tobacco use	-.434	.519	-.051	-.837	.403
	Alcohol	.847	.294	.147	2.877	.004*
	Body mass index	-.095	.036	-.139	-2.606	.010*
	MSK (spine)	-1.464	.818	-.096	-1.789	.074
	MSK (shoulder)	-.537	.313	-.088	-1.714	.087
	PCM (PT)	.835	.393	.113	2.123	.034*
	PCM (DO)	-1.100	.992	-.056	-1.110	.268
	PCM (PA)	.206	.397	.029	.518	.605
	PCM (ARNP)	-1.194	.679	-.089	-1.758	.080

a. Dependent Variable: Number of imaging studies. *Note*. Musculoskeletal (MSK); Primary care manager (PCM); Physical therapist (PT); Doctor of osteopathic medicine (DO); Physician assistant (PA); Advanced registered nurse practitioners (ARNP)

Second, Table 10 summarized the results of the hierarchical linear regression to determine the individual effects of the demographics, patient characteristics, comorbidities, and PCM types on medication use of MSK patients. The regression results showed that the model fit of the regression model $F(4, 2433) = 146.53$, $p < 0.000$ was significant, indicating that the regression model had an acceptable model fit. The *r* square value of the regression model was 0.35, which indicates a moderate effect size. The combined effect size of the different independent and

control variables on the dependent variable of medication use was moderate.[142] The different independent and control variables captured 36% of the variance of medication use.

Prior to control the effects of the control variables, investigation of the significance of their individual effects showed that patient age ($t(2795) = 13.248$, $p < 0.001$), patient gender ($t(2795) = 3.066$, $p < 0.002$), patient income ($t(2795) = -3.513$ $p < 0.001$), and patient BMI ($t(2795) = 4.650$, $p < 0.001$) have significant effects on medication use. Investigation of the unstandardized beta coefficient value showed that MSK patients with PCM types of PT (-21.96) had a negative coefficient, while MSK patients with PCM types of MD (3.047) had positive coefficient. This indicated that the least medication use by the MSK patients occurred when their PCMs were PTs, while the greatest medication use by the MSK patients occurred if their PCMs were MDs.

Table 10

Hierarchical Linear Regression Results of Effects of PCM Types on Medication Use While Controlling Demographics and Patient Morbidities

Model		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.766	2.927		.945	.345
	Age category	6.534	.493	.431	13.248	.001*
	Gender	3.536	1.153	.107	3.066	.002*
	Marital status	-1.774	1.159	-.053	-1.530	.126
	Ethnicity (white)	3.209	2.532	.102	1.267	.205
	Ethnicity (black)	1.706	2.574	.021	.663	.508
	Ethnicity (Hispanic)	1.884	10.153	.006	.186	.853
	Ethnicity (Asian)	1.761	3.097	.028	.569	.570
	Ethnicity (other non-white)	3.939	2.599	.120	1.516	.130
	Patient Income (sponsor rank group)	-2.705	.770	-.122	-3.513	.001*
2	(Constant)	-14.140	4.379		-3.229	.001*
	Age category	5.739	.509	.378	11.282	.001*
	Gender	3.775	1.162	.114	3.248	.001*
	Marital status	-1.688	1.162	-.050	-1.452	.147
	Ethnicity (white)	2.905	2.511	.092	1.157	.248
	Ethnicity (black)	2.244	2.539	.028	.884	.377
	Ethnicity (Hispanic)	1.416	10.236	.004	.138	.890
	Ethnicity (Asian)	.117	3.197	.002	.037	.971
	Ethnicity (other non-white)	3.760	2.564	.115	1.466	.143
	Patient income (sponsor rank group)	-1.860	.775	-.084	-2.400	.017*
	Tobacco use	1.637	1.637	.035	1.000	.318
	Alcohol	-.938	1.004	-.029	-.935	.350
	Body mass index	.587	.108	.171	5.413	.001*
	MSK (spine)	-.374	2.317	-.005	-.161	.872
	MSK (shoulder)	-.164	1.081	-.005	-.152	.880

(Continued on next page)

Model		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
		B	Std. Error	Beta	t	Sig
3	(Constant)	-5.435	13.239		-.411	.682
	Age category	4.970	.481	.328	10.323	.001*
	Gender	1.054	1.104	.032	.955	.340
	Marital status	-1.589	1.083	-.047	-1.467	.143
	Ethnicity (white)	1.807	2.330	.057	.775	.438
	Ethnicity (black)	1.409	2.358	.017	.598	.550
	Ethnicity (Hispanic)	-3.208	9.535	-.010	-.336	.737
	Ethnicity (Asian)	-4.036	2.986	-.064	-1.352	.177
	Ethnicity (other non-white)	1.812	2.383	.055	.761	.447
	Patient Income (sponsor rank group)	-2.145	.720	-.097	-2.981	.003*
	Tobacco use	.876	1.527	.019	.574	.566
	Alcohol	-2.435	.943	-.076	-2.583	.010*
	Body mass index	.485	.104	.141	4.650	.001*
	MSK (spine)	-.702	2.175	-.010	-.323	.747
	MSK (shoulder)	-.460	1.010	-.014	-.455	.649
	PCM (PT)	-11.305	12.809	-.289	-.883	.378
	PCM (MD)	3.047	12.811	.097	.238	.812
	PCM (DO)	2.453	13.312	.018	.184	.854
	PCM (PA)	2.069	12.799	.059	.162	.872
	PCM (ARNP)	1.244	12.921	.018	.096	.923

a. Dependent variable: Number of scripts. *Note*. Musculoskeletal (MSK); Primary care manager (PCM); Physical therapist (PT); Medical doctor (MD); Doctor of osteopathic medicine (DO); Physician assistant (PA); Advanced registered nurse practitioners (ARNP)

Third, Table 11 summarized the results of the hierarchical linear regression to determine the individual effects of the demographics, patient characteristics, comorbidities, and PCM types on number of visits or RTW rates of MSK patients. The regression results showed that the model fit of the regression model ($F[4, 2504] = 6.153$, $p < 0.001$) was significant, indicating that the regression model had an acceptable model fit. The *r* square value of the regression model was

0.037, which indicated a very low effect size. The combined effect size of the different independent and control variables on the dependent variable of number of visits or RTW rates was very low. The different independent and control variables captured only 3% of the variance of number of visits or RTW rates.

Prior to control the effects of the control variables, investigation of the significance of their individual effects showed that patient age (t[2852] = -2.188, $p < 0.029$), Asian ethnicity (t[2852] = 3.168, $p < 0.002$), and patient income (t[2852] = 4.577, $p = 0.01$), had significant effects on number of visits or RTW rates. Conversely, after controlling the demographics, patient characteristics, and comorbidities, it was determined that the MSK patient's PCM type did not have any significant effect on the number of visits or RTW rates of the MSK patients.

Table 11

Hierarchical Linear Regression Results of Effects of PCM Types on Number of Visits or RTW Rates While Controlling Demographics and Patient Comorbidities

		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
Model		B	Std Error	Beta	t	Sig.
1	(Constant)	1.121	.173		6.483	.001
	Age category	-.063	.029	-.079	-2.188	.029*
	Gender	.114	.068	.065	1.679	.093
	Marital status	.085	.068	.048	1.256	.210
	Ethnicity (white)	.206	.150	.124	1.375	.169
	Ethnicity (black)	-.088	.148	-.021	-.593	.553
	Ethnicity (Hispanic)	-.153	.602	-.009	-.254	.799
	Ethnicity (Asian)	.581	.183	.171	3.168	.002*
	Ethnicity (other non-white)	.104	.153	.060	.676	.499
	Patient income (sponsor rank group)	.005	.045	.004	.108	.914

(Continued on next page)

Model		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
		B	Std. Error	Beta	t	Sig.
2	(Constant)	1.197	.262		4.577	.001*
	Age category	-.062	.030	-.077	-2.045	.041
	Gender	.105	.070	.060	1.508	.132
	Marital status	.082	.070	.046	1.184	.237
	Ethnicity (white)	.200	.151	.120	1.329	.184
	Ethnicity (black)	-.092	.149	-.022	-.623	.534
	Ethnicity (Hispanic)	-.174	.618	-.010	-.282	.778
	Ethnicity (Asian)	.597	.193	.176	3.100	.002*
	Ethnicity (other non-white)	.102	.154	.059	.661	.509
	Patient income (sponsor rank group)	.002	.046	.002	.044	.965
	Tobacco use	.024	.098	.010	.244	.808
	Alcohol	-.080	.060	-.047	-1.339	.181
	Body mass index	-.001	.006	-.005	-.131	.896
	MSK (spine)	.058	.140	.015	.416	.677
	MSK (shoulder)	.002	.065	.001	.035	.972
3	(Constant)	.555	.861		.644	.520
	Age category	-.053	.031	-.066	-1.728	.084
	Gender	.144	.071	.082	2.023	.043
	Marital status	.080	.070	.045	1.152	.250
	Ethnicity (white)	.224	.151	.134	1.483	.139
	Ethnicity (black)	-.080	.149	-.019	-.536	.592
	Ethnicity (Hispanic)	-.103	.620	-.006	-.165	.869
	Ethnicity (Asian)	.648	.194	.191	3.343	.001*
	Ethnicity (other non-white)	.133	.154	.077	.860	.390
	Patient income (sponsor rank group)	.007	.046	.006	.150	.881
	Tobacco use	.041	.098	.016	.419	.675
	Alcohol	-.057	.061	-.034	-.940	.347
	Body mass index	.000	.007	-.003	-.070	.944
	MSK (spine)	.055	.141	.014	.392	.695
	MSK (shoulder)	.004	.065	.002	.068	.946
	PCM (PT)	.701	.834	.336	.840	.401
	PCM (MD)	.511	.834	.307	.613	.540
	PCM (DO)	.318	.866	.045	.367	.713

PCM (PA)	.523	.833	.281	.627	.531
PCM (ARNP)	.558	.840	.154	.664	.507

a. Dependent Variable: RTW rate. *Note*. Musculoskeletal (MSK); Primary care manager (PCM); Physical therapist (PT); Medical doctor (MD); Doctor of osteopathic medicine (DO); Physician assistant (PA); Advanced registered nurse practitioners (ARNP)

Fourth, Table 12 summarized the results of the hierarchical linear regression to determine the individual effects of the demographics, patient characteristics, comorbidities and PCM types on mean diagnostic imaging cost for initial MSK injury encounter of MSK patients. SPSS was not able to create a regression with acceptable model fit. However, the *r* square value of the regression model was 1.00, which indicated a perfect linear relationship. The regression model showed the individual effects of white ethnicity ($t[2852] = 2.64$, $p < 0.08$), Hispanic ethnicity ($t[2852] = 6.166$, $p < 0.00$), patient income (t[2852] = 2.267. $p < .024$, MSK spine (t[2852]).

Table 12

Hierarchical Linear Regression Results of Effects of PCM Types on Mean Diagnostic Imaging Cost While Controlling Demographic and Patient Comorbidities

		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
Model		B	Std. Error	Beta	t	Sig
1	(Constant)	56.894	2.427		23.440	.001
	Age category	-.248	.405	-.021	-.612	.541
	Gender	.963	.954	.038	1.009	.313
	Marital status	4.710	.955	.181	4.932	.001
	Ethnicity (white)	5.559	2.099	.230	2.648	.008
	Ethnicity (black)	1.282	2.075	.021	.618	.537
	Ethnicity (Hispanic)	52.111	8.451	.206	6.166	.001
	Ethnicity (Asian)	-.578	2.573	-.012	-.225	.822
	Ethnicity (other non-white)	1.915	2.154	.076	.889	.374
	Patient income (sponsor rank)	1.433	.632	.084	2.267	.024

(Continued on next page)

Model		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
		B	Std. Error	Beta	t	Sig.
2	(Constant)	59.667	.000		328975044.083	.001
	Age c	-1.017E-013	.000	.000	.000	1.000
	Gender	1.006E-013	.000	.000	.000	1.000
	Marital status	1.073E-013	.000	.000	.000	1.000
	Ethnicity (white)	1.093E-013	.000	.000	.000	1.000
	Ethnicity (black)	1.031E-013	.000	.000	.000	1.000
	Ethnicity (Hispanic)	1.629E-013	.000	.000	.000	1.000
	Ethnicity (Asian)	1.130E-013	.000	.000	.000	1.000
	Ethnicity (other non-white)	1.037E-013	.000	.000	.000	1.000
	Patient Income (sponsor ran)	1.014E-013	.000	.000	.000	1.000
	Tobacco use	-1.014E-013	.000	.000	.000	1.000
	Alcohol	1.052E-013	.000	.000	.000	1.000
	Body mass index	1.007E-013	.000	.000	.000	1.000
	MSK (spine)	56.667	.000	1.005	585668367.474	.001
	MSK (shoulder)	7.000	.000	.270	156510862.770	.001
3	(Constant)	59.667	.000		99513161.263	.001
	Age category	-1.009E-013	.000	.000	.000	1.000
	Gender	1.016E-013	.000	.000	.000	1.000
	Marital status	1.070E-013	.000	.000	.000	1.000
	Ethnicity (white)	1.096E-013	.000	.000	.000	1.000
	Ethnicity (black)	1.043E-013	.000	.000	.000	1.000
	Ethnicity (Hispanic)	1.569E-013	.000	.000	.000	1.000
	Ethnicity (Asian)	1.163E-013	.000	.000	.000	1.000
	Ethnicity (other non-white)	1.048E-013	.000	.000	.000	1.000
	Patient income (sponsor rank)	1.014E-013	.000	.000	.000	1.000
	Tobacco use	1.003E-013	.000	.000	.000	1.000
	Alcohol	1.060E-013	.000	.000	.000	1.000
	Body mass index	1.009E-013	.000	.000	.000	1.000
	MSK (spine)	56.667	.000	1.005	576630892.897	.001
	MSK (shoulder)	7.000	.000	.270	154713782.243	.001

(Continued on next page)

Model	Coefficients				
	Unstandardized coeff.		Standardized coeff.		
	B	Std. Error	Beta	t	Sig.
PCM (PT)	-1.126E-013	.000	.000	.000	1.000
PCM (MD)	-1.256E-013	.000	.000	.000	1.000
PCM (DO)	-1.355E-013	.000	.000	.000	1.000
PCM (PA)	-1.138E-013	.000	.000	.000	1.000
PCM (ARNP)	-1.229E-013	.000	.000	.000	1.000

a. Dependent variable: Mean diagnostic imaging cost = 585668367.474, $p < 0.05$, and shoulder diagnosis (t[2852] = 156510862.770, $p < 0.00$ had significant effects on mean diagnostic imaging cost for initial MSK injury encounter.

Note. Musculoskeletal (MSK); Primary care manager (PCM); Physical therapist (PT); Medical doctor (MD); Doctor of osteopathic medicine (DO); Physician assistant (PA); Advanced registered nurse practitioners (ARNP)

Fifth, Table 13 summarized the results of the hierarchical linear regression to determine the individual effects of the demographics, patient characteristics, comorbidities, and PCM types on medication use cost of MSK patients. The regression results showed that the model fit of the regression model *(F*[4, 2504] = 49.191, $p < 0.001$) was significant, indicating that the regression model had an acceptable model fit. The *r* square value of the regression model was 0.34, which indicated a moderate effect size.[141] The combined effect size of the different independent and control variables on the dependent variable of mf149edication use cost was moderate. The different independent and control variables captured 34% of the variance of medication use.

Prior to control the effects of the control variables, investigation of the significance of their individual effects showed that patient age (*t*[2852] = 13.52, $p < 0.001$), patient gender (*t*[2852] = 3.24, $p < 0.001$), patient income (*t*[2852] = -3.65 $p < 0.001$), patient BMI (*t*[2852] = 5.361, $p < 0.001$), had significant effects on medication use cost. After controlling the demographics and patient characteristics and comorbidities, it was determined that PCM types MD (*t*[2852] = 4.41, $p < 0.001$), DO (*t*[2852] = 5.43, $p < 0.001$), PA (*t*[2852] = 4.54, $p < 0.001$), and ARNP (*t*[2852]

= 4.18, $p < 0.001$) had significant effects on the medication use of the MSK patients. Investigation of the unstandardized beta coefficient value showed that MSK patients with PCM types of MD (144.74), DO (139.27), PA (131.28), and ARNP (86.15) all had positive coefficient. These indicated that MSK patients incurred greater medication use costs when their PCMs were MDs, DOs, PAs, and ARNPs. Comparison of the unstandardized beta coefficient values showed that MSK patients with MD PCMs had the greatest medication use cost, while MSK patients with PT PCMs had the lowest medication use cost.

Table 13

Hierarchical Linear Regression Results of Effects of PCM Types on Medication Use Cost While Controlling Demographics and Patient Characteristics and Comorbidities

		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
Model		B	Std. Error	Beta	T	Sig
1	(Constant)	58.008	63.566		.913	.362
	Age Category	146.191	10.617	.440	13.769	.001
	Gender	81.192	24.994	.111	3.249	.001
	Marital Status	-35.003	25.005	-.047	-1.400	.162
	Ethnicity (White)	65.915	54.982	.096	1.199	.231
	Ethnicity (Black)	33.696	54.349	.019	.620	.535
	Ethnicity (Hispanic)	39.969	221.332	.006	.181	.857
	Ethnicity (Asian)	37.732	67.388	.027	.560	.576
	Ethnicity (Other non-white)	78.185	56.403	.109	1.386	.166
	Patient Income (Sponsor Rank Group)	-60.582	16.559	-.125	-3.658	.001
2	(Constant)	-302.828	94.556		-3.203	.001
	Age Category	129.061	10.969	.388	11.766	.001
	Gender	85.876	25.184	.117	3.410	.001
	Marital Status	-34.542	25.123	-.046	-1.375	.170
	Ethnicity (White)	59.344	54.535	.086	1.088	.277
	Ethnicity (Black)	45.318	53.673	.026	.844	.399
	Ethnicity (Hispanic)	27.403	223.314	.004	.123	.902

(Continued on next page)

Model		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
		B	Std. Error	Beta	t	Sig.
	Ethnicity (Asian)	2.257	69.577	.002	.032	.974
	Ethnicity (Other non-white)	73.405	55.683	.102	1.318	.188
	Patient Income (Sponsor Rank Group)	-42.794	16.675	-.088	-2.566	.010
	Tobacco Use	36.496	35.271	.035	1.035	.301
	Alcohol	-19.964	21.616	-.028	-.924	.356
	Body Mass Index	12.537	2.339	.167	5.361	.001
	MSK (Spine)	-3.578	50.443	-.002	-.071	.943
	MSK (Shoulder)	.126	23.317	.000	.005	.996
3	(Constant)	-207.270	290.327		-.714	.475
	Age Category	115.416	10.383	.347	11.115	.001
	Gender	31.233	24.013	.043	1.301	.194
	Marital Status	-28.341	23.509	-.038	-1.206	.228
	Ethnicity (White)	30.586	50.911	.044	.601	.548
	Ethnicity (Black)	22.050	50.164	.013	.440	.660
	Ethnicity (Hispanic)	-84.462	209.180	-.012	-.404	.686
	Ethnicity (Asian)	-85.027	65.360	-.060	-1.301	.194
	Ethnicity (Other non-white)	26.868	52.059	.037	.516	.606
	Patient Income (Sponsor Rank Group)	-49.400	15.563	-.102	-3.174	.002
	Tobacco Use	21.094	33.093	.020	.637	.524
	Alcohol	-53.687	20.445	-.077	-2.626	.009
	Body Mass Index	10.498	2.253	.140	4.660	.001
	MSK (Spine)	-2.697	47.585	-.002	-.057	.955
	MSK (Shoulder)	-3.176	21.908	-.004	-.145	.885
	PCM (PT)	-156.340	281.114	-.181	-.556	.578
	PCM (MD)	144.749	281.108	.210	.515	.607
	PCM (DO)	139.273	292.126	.047	.477	.634
	PCM (PA)	131.286	280.887	.170	.467	.640
	PCM (ARNP)	86.155	283.362	.058	.304	.761

a. Dependent Variable: Medication Use Cost

Note. Musculoskeletal (MSK); Primary care manager (PCM); Physical therapist (PT); Medical doctor (MD); Doctor of osteopathic medicine (DO); Physician assistant (PA); Advanced registered nurse practitioners (ARNP)

Note. Musculoskeletal (MSK); Primary care manager (PCM); Physical therapist (PT); Medical doctor (MD); Doctor of osteopathic medicine (DO); Physician assistant (PA); Advanced registered nurse practitioners (ARNP)

Sixth, Table 14 summarized the results of the hierarchical linear regression to determine the individual effects of the demographics, patient characteristics, comorbidities, and PCM types on cost of visit of MSK patients. The regression results showed that the model fit of the regression model (F[20, 2832] = 13.19, $p < 0.001$) was significant, indicating that the regression model had an acceptable model fit. The r square value of the regression model was 0.11, which indicated a small effect size.[142]

Prior to controlling the effects of the control variables, investigation of the significance of their individual effects showed that patient gender (t[2852] = 3.74, $p < 0.00$) and Asian ethnicity (t[2852] = 4.57, $p < 0.001$) had significant effects on cost of visit. Conversely, after controlling the demographics and patient characteristics and comorbidities, it was determined that having PCM types of MD (t[2852] = 3.37, $p < 0.001$), PA (t[2852] = 4.19, $p < 0.001$), and ARNP (t[2852] = 2.38, $p = 0.02$) had significant effects on the cost of visit of the MSK patients. Comparison of the unstandardized beta coefficient value showed that MSK patients with ARNP PCMs had the greatest cost of visit, MSK patients with PA, MD, and DO PCMs, while MSK patients with PT PCMs had the lowest cost per visit.

Table 14

Hierarchical Linear Regression Results of Effects of PCM Types on Cost of Visit While Controlling Demographics and Patient Characteristics and Comorbidities

		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
Model		B	Std. error	Beta	t	Sig
1	(Constant)	154.627	32.522		4.755	.001
	Age category	-2.907	5.432	-.019	-.535	.593
	Gender	47.882	12.787	.143	3.744	.001
	Marital status	16.567	12.793	.049	1.295	.196

(Continued on next page)

		Coefficients				
		Unstandardized coeff.		Standardized coeff.		
Model		B	Std. Error	Beta	t	Sig
	Ethnicity (white)	42.954	28.130	.136	1.527	.127
	Ethnicity (black)	-7.874	27.806	-.010	-.283	.777
	Ethnicity (Hispanic)	20.674	113.238	.006	.183	.855
	Ethnicity (Asian)	157.651	34.477	.244	4.573	.001
	Ethnicity (other non-white)	34.528	28.857	.105	1.197	.232
	Patient Income (sponsor rank group)	5.520	8.472	.025	.652	.515
2	(Constant)	129.986	49.206		2.642	.008
	Age category	-3.964	5.708	-.026	-.694	.488
	Gender	49.644	13.105	.148	3.788	.001
	Marital status	14.581	13.074	.043	1.115	.265
	Ethnicity (white)	41.163	28.380	.130	1.450	.147
	Ethnicity (black)	-6.498	27.931	-.008	-.233	.816
	Ethnicity (Hispanic)	5.327	116.210	.002	.046	.963
	Ethnicity (Asian)	148.537	36.207	.230	4.102	.001
	Ethnicity (other non-white)	34.624	28.977	.105	1.195	.232
	Patient Income (sponsor rank group)	6.153	8.677	.028	.709	.478
	Tobacco use	13.674	18.355	.029	.745	.456
	Alcohol	3.114	11.249	.010	.277	.782
	Body mass index	.699	1.217	.020	.575	.566
	MSK (spine)	17.563	26.250	.024	.669	.504
	MSK (shoulder)	5.408	12.134	.016	.446	.656
3	(Constant)	-86.638	157.504		-.550	.582
	Age category	-9.267	5.633	-.061	-1.645	.100
	Gender	32.410	13.027	.097	2.488	.013

(Continued on next page)

	Coefficients				
	Unstandardized coeff.		Standardized coeff.		
Model	B	Std. Error	Beta	t	Sig.
Marital status	17.290	12.754	.051	1.356	.176
Ethnicity (white)	32.949	27.619	.104	1.193	.233
Ethnicity (Black)	-12.593	27.214	-.016	-.463	.644
Ethnicity (Hispanic)	-32.778	113.481	-.010	-.289	.773
Ethnicity (Asian)	117.975	35.458	.183	3.327	.001
Ethnicity (other non-white)	18.412	28.242	.056	.652	.515
Patient Income (sponsor rank group)	4.029	8.443	.018	.477	.633
Tobacco use	11.380	17.953	.024	.634	.526
Alcohol	-7.495	11.092	-.023	-.676	.499
Body mass index	-.002	1.222	.000	-.002	.999
MSK (spine)	14.118	25.815	.019	.547	.585
MSK (shoulder)	4.734	11.885	.014	.398	.690
PCM (PT)	195.210	152.506	.492	1.280	.201
PCM (MD)	293.588	152.503	.927	1.925	.055
PCM (DO)	253.036	158.480	.186	1.597	.111
PCM (PA)	296.770	152.383	.838	1.948	.052
PCM (ARNP)	302.640	153.726	.440	1.969	.049

a. Dependent Variable: Cost of Visit.

Note. Musculoskeletal (MSK); Primary care manager (PCM); Physical therapist (PT); Medical doctor (MD); Doctor of osteopathic medicine (DO); Physician assistant (PA); Advanced registered nurse practitioners (ARNP)

Summary

The purpose of the study was to determine associations between variables as well as make comparisons between PCM groups or to examine differences in cost of care for MSK patients between the five PCM groups in the DoD: (a) PTs, (b) MDs, (c) DOs, (d) Pas, and (e) ARNPs. Results of the one-way ANOVA showed that imaging use, medication use, number of visits (or RTW rates), mean diagnostic imaging cost, medication use cost, and cost of visits for

MSK patients were significantly different among different type of PCMs. Results of the hierarchical linear regression revealed the conclusions regarding the study hypotheses, as listed below.

- **Hypothesis 1:** PT management of patients with MSK disorders resulted in a lower rate of imaging studies when compared to MD, DO, PA or ARNP management of patients with MSK disorders.
- **Hypothesis 2:** PT management of patients with MSK disorders resulted in a lower volume of NSAIDS medication, when compared to management MSK patients by MDs, DOs, PAs, or ARNPs.
- **Hypothesis 3**: Patients with MSK disorders managed by PTs had no significant difference in number of visits when compared to patients with MSK disorders managed by MDs, DOs, PAs, or ARNPs.
- **Hypothesis 4:** Patients with MSK disorders who were managed by PTs demonstrated a significantly decreased cost of care when compared to patients with MSK disorders who were managed by MDs, DOs, PAs, or ARNPs.

Chapter five includes further discussion of the results presented in this chapter. Each of the results of the different statistical analyses will be reviewed, and the potential implications for each of the results of the analysis will be discussed in the succeeding chapter.

Chapter 5: Discussion and Summary

Overview

The profession of physical therapy continues to advance into the 21st century. Entry level degree standards have increased from the initial requirement in the 1960s of a certificate level, to a bachelor's degree, then to a master's degree and now to a clinical Doctor of Physical Therapy degree for all U.S. CAPTE accredited programs. This increase in entry level degree requirements – a result of the need of the profession to increase the entry level knowledge and skill set – provides DPT program graduates the educational tools they need to warrant increased clinic practice priviledges.[150] With the expansion of entry-level curricular content to include pharmacology, radiology and differential diagnosis, the ability of a PT to serve as an entry-level professional for patients in certain areas is a logical step, although, as in the military, there may need to be some additional clinical training. As of January 1, 2015, all 50 states as well as the District of Columbia and the U.S. Virgin Islands allow patients to seek some level of treatment from a licensed PT without a prescription or referral from a physician.[151] These changes in referral patterns, have not necessarily been accompanied by changes in reimbursement to enable billing, or to provide the ability to order medications or order medical testing such as x-ray and basic laboratory test. Therefore, researchers have not examined the cost of PTs serving as autonomous front-line PCMs compared to traditional PCMs for patient with MSK disorders in any nonmilitary settings. Physical therapists who practice in a military medical clinic, however, have limited prescription, laboratory and image ordering privileges, which allow services to be offered in a similar practice model to traditional PCM care. This study provided the unique opportunity to be able to examine PTs in the PCM compared to traditional PCMs.

The purpose of this study was to examine the cost of PTs serving as the PCM for patients with musculoskeletal (MSK) disorders and then comparing PTs to the other four PCM groups who provide services at a small Air Force military medical treatment facility (MTF). These groups were, Physical Therapists (PTs), Medical Doctors (MDs), Doctors of Osteopathic Medicine (DOs), Physician Assistants (PAs), and Advanced Registered Nurse Practitioners (ARNPs). Cost, for this study, was defined by cost of care using imaging, medication, cost of visit, time to return to work, and overall return to work rate.

This study used an exploratory, retrospective, non-experimental, cross-sectional, quantitative design. Associations between variables and comparisons between PCM groups involved both correlational and comparative design. Hierarchical linear regression and hierarchical logistic regressions were used to test the hypothesis that PTs are more effective PCMs for MSK patients than traditional PCMs. Traditional military PCMs function similarly to PCMs in non-military medical facilities. Bi-variate relationships between the factors of the demographics, comorbidities, treatments, MSK groups, PCM groups, and the dependent variables relating to the cost of care were investigated, as was the time involved in a full return to work. Comparison of the five PCM groups was accomplished using regressions and correlations. Correlational methods were used for the comparative element of the study.

Summary of Results

The results showed that PTs, practicing in an Air Force medical clinic, serving as a PCM for patients with MSK disorders, had significantly less radiology usage, decreased non-steroidal anti-inflammatory prescription rate, decreased cost of care, but no significant effect on time to return to duty or work. Results of the hierarchical linear regression supported three of the four alternate hypotheses. Each finding will be discussed in detail in the following sections.

Discussions of Findings

Imaging

One-way ANOVA and Tukey post hoc testing revealed that for plain-film imaging, PAs and ARNPs functioning as PCMs ordered significantly more imaging studies of their MSK patients than did PTs, MDs or DOs functioning as PCMs, by mean differences of -0.10, .42 and 0.54, respectively, with PTs ordering the fewest imaging studies.

Examination of the efficacy of giving PT radiology practice privileges comparable to those given to typical PCMs is not reported in the literature. Radiology usage for all PCM groups was higher than that of PTs serving as PCMs. Overall patient acuity was similar in all five groups, with PTs, on average, seeing patients with a pain rating of five out of 10, and the other PCMs,on average, seeing patients with a pain rating of 4 out of 10.

Defensive medicine is defined as the ordering of tests and imaging in an effort to limit the chance of litigation.[152] Training with a defensive medicine mindset could have caused the increased imaging orders in the non-PT PCM groups. The use of radiology clinical practice guidelines for appropriateness of ordering imaging has been estimated in multiple studies by the American College of Radiology (ACR). [153,154] In a nationwide survey, physicians were asked if they consulted the ACR appropriateness criteria prior to ordering radiology studies.[153] Of the 126 survey respondents, two physicians (1.59%) reported that they did, while four physicians reported that they asked colleagues. Compiling the responses of both resident and attending physicians overall, respondents reported the top three most frequently used resources as: radiologist consult (n = 81, 64.3%), a specialty journal (n = 61, 48.4%), up-to-date (n = 52, 41.3%), and Google (n = 35, 27.8%).[153] The examination of emergency room physicians showed that more than 70% of radiology studies did not meet any clinical practice guidelines.[154] It was

reported this practice pattern is primarily due to the use of defensive medicine and litigation fears.[154,179] Physical therapists are evaluating patients in the ER as direct access providers. As the profession moves forward and imaging privileges become standard practice, careful examination of imaging practice patterns for PTs will be necessary for ensuring the use of clinical practice guidelines in all settings. This will be essential to help contain costs while also permitting the use of the imaging or tests that best assess injuries without the first concern being provider litigation protection.

Increasing healthcare expenditures continue to plague the United States, with overuse of imaging by PCMs contributing significantly to rising costs.[155] Reasons for imaging overuse by PCMs can include fear of liability if the imaging was not ordered and something was "missed," and can also stem from an incomplete understanding or failure to use imaging clinical practice guidelines.[156] Medicare reports that imaging services among physicians grew at a rate of 85% per beneficiary between 2000 and 2009, outpacing all other categories of physician services other than laboratory tests.[157] Doctoral PT programs currently follow the same radiology curricular recommendations set out by U.S. medical school curricula.[158] Although DPT programs are educating PTs in the same manner as medical students are being educated in regard to radiology indications and guidelines, DPT students completing their terminal clinical education are unable to practice the imaging skill set due to restrictive state practice acts that do not allow PTs to order imaging. However, if DPT students complete clinical rotations in a military treatment clinic or hospital, they are allowed, under the guidance of a clinical instructor, to practice the imaging skill set. Doctoral PT students practice using imaging clinical practice guidelines (CPGs) on imaging types including MRIs and computerized tomography if the military facilities have these services, and also have the opportunity to interpret imaging results under the guidance of a

radiologist. The ability to practice imaging use as a necessary part of developing clinical skills for autonomous PT practice is critical for PTs to function up to their educational capacities.

This study was unable to assess electronic healthcare documentation data to determine if use of radiology CPGs guided decision making of these five PCM groups. It was not possible to assess each individual record for PCM imaging, CPG free-text documentation, as there was no check box that recorded this information. There are multiple studies that have examined the efficacy of the military model of PT in which the ability to order radiology has been common since the early 70's. These studies have demonstrated that military PTs order imaging prudently and have not negatively affected patient safety. [159] The civilian sector is recognizing that PTs have the clinical skill sets required to competently acquire radiology ordering privileges. Kaiser Permanente Northern California developed specific radiology competencies for PTs who practice in their healthcare system. [160,161] Kaiser has moved physical therapy to a primary care, front-line provider for MSK conditions, with x-ray privileges granted once the specific clinical competencies are satisfied.[161] Kaiser, like the military, developed specific pathways for PTs to provide primary care by using PTs in a way that would ensure full use of their clinical capacities. Kaiser, like the military, realized that PTs had an unused skill set that could be used to provide care to certain patient types.

As of 2016, Wisconsin is the first state to allow PTs to order imaging.[162] The Wisconsin legislature passed a bill specifying the qualifications and training a PT must have to order imaging as follows:

1. the physical therapist holds a clinical doctorate degree in physical therapy;
2. the physical therapist has completed a nationally recognized specialty certification program;

3. the physical therapist has completed a nationally recognized residency or fellowship certified by an organization recognized by the examining board; and
4. the physical therapist has completed a formal X-ray ordering training program with demonstrated physician involvement.

Even though the Bill passed the Wisconsin legislature, the Wisconsin Physical Therapy Examination Board, as of February 2017, advised PTs not to order radiology studies.[163] The Wisconsin Radiology Examining Board (REB) reports that the current scope of practice for radiographers involves the production of images for the interpretation by an independent medical provider, which according to REB, PTs are not. Additionally, since PTs are not considered by federal law to be independent medical providers, neither Medicare nor Medicaid pay for images ordered by PT's, which could leave the patient responsible for the imaging cost.[164] Medicaid laws stipulate that imaging must be ordered and performed by or under the direction of a physician.[165] Essentially, according to Medicaid laws, a PT working under the direct supervision of a physician would be able to order imaging as long as the physician signed the order.

The results of this study demonstrated the prudent use of imaging by two PT's in a single military treatment facility with approximately 1,700 patients evaluated through direct access over a period of 18 months. Allowing PTs to use radiology exams when clinical indicators dictate a need could help reduce healthcare costs without negatively effecting quality care and outcomes. Use of imaging CPGs and a thorough MSK exam by these two PTs to clarify patients' clinical presentations, helping to sort patients who evidence-based medicine would indicate need further evaluation.

Medications (NSAIDs)

One-way ANOVA and Tukey post hoc testing revealed that for medication use, PTs acting as PCMs for MSK patients prescribed significantly less medication (NSAIDs) than MDs, DOs, PAs, and ARNPs acting as PCMs for MSK patients, by mean differences of –16.1133, -9.9057, -13.8669, and -12.6703, respectively.

The PTs in this study prescribed significantly fewer NSAIDs than their MD, DO, PA and ARNP counterparts. There could be several reasons for this difference, including the possibility that patient expectations are different when seeing a PT PCM for an MSK condition than when seeing a non-PT PCM for one. Often, prescriptions from family practice providers are recognized by patients as a key indicator of receiving quality care.[166] Also contributing the difference in medication levels could be the fact that a typical PT PCM appointment is 30 minutes in length, while a typical non-PT PCM appointment is 15 minutes shorter. In a study examining prescription rates, researchers concluded that the more time a PCM spent listening to the patient, the less medication was prescribed.[167] Having more time with patients may reduce the PT's reliance on medication to address pain.

In the U.S., only the military grants PTs practice privileges to prescribe medications – specifically NSAIDs. However, since 2006, PTs in the United Kingdom (UK) were able to prescribe medication as supplementary prescribers, requiring a physician's co-signature on their prescriptions.[168] Physical therapists in the UK have been using medicines for injection therapy since the early 1990s under physician supervision the way that PAs have been doing in the United States. Since 2000, local anesthetics and corticosteroids have been used extensively by the estimated 3,000 PTs in the UK. Supplementary prescribing is also used in a broad range of community and acute settings. Physical therapists in the UK use these practice privileges within

a range of relevant medicines in clinical areas including musculoskeletal treatment, pain management, neurological care, respiratory treatment, emergency care, women's health, pediatrics, and geriatric medicine. These medications are not limited to a certain class such as NSAIDs, but are specific to the type of practice setting and covers all types of medication, including narcotics.[168] When this initiative yielded positive results and no reported patient, PTs in the UK were granted independent prescribing privileges in 2012.[168] The Chartered Society of Physiotherapy noted that it "would like to see the same changes take place in the United States of America," but said it is "doubtful that the American medical establishment would be as supportive of physical therapists as the British physicians seem to be; fear of lower physician salaries would draw political opposition from the American Medical Association."[169]

Advanced practice UK physiotherapists can prescribe not only NSAIDs, but also any licensed medicine relevant to their particular scope of practice, and medication for a wide range of conditions such as asthma, neurological disorders, joint conditions, women's health problems, and pain.[170] The educational standards and clinical internships of UK PTs support prescribing responsibilities similar to that of nurses and pharmacists. The 2017 World Confederation for Physical Therapy Congress noted its support for professional practice autonomy for PTs, provided they have sufficient knowledge and competence in their field of practice.[170]

Pharmacology is a primary content area that is a required component of all U.S. DPT program curricula.[171] The ability for PTs to prescribe medication is currently not the pharmacology content goal of U.S. DPT programs. Current PT pharmacology course content is structured to examine various aspects of pharmacology, with emphasis on drug interaction and effects of PT treatments on drug interaction. However, it could be argued that the ability to function as an independent medical practitioner should not be limited by restrictions in practice

privileges. Non-physician, front-line providers such as PAs and ARNPs are credentialed to prescribe medication and, in the instance of ARNPs, can practice independent of physician oversight.

NSAIDs are the most frequently prescribed medicines for analgesia in primary care.[172] At any given time 10-15% of the U.S. population is on some form of NSAID.[172] Even though the cost of NSAIDs, relative to other prescribed medications is relativity low, the frequency with which it is prescribed to patients with MSK conditions is high, with cost estimates at $2.2 billion per year for 98 million prescriptions.[173] Complications from NSAID overuse can be life-threating. NSAIDs raise the risk of heart failure by 20%, do gastrointestinal damage, increase the risk of renal failure, and pose specific dangers to children and teenagers.[174] Providers who assume the responsibility of prescribing NSAIDs must be fully trained concerning all potential adverse effects.

This study demonstrates that the judicious use of NSAIDs by PTs resulted in prescription cost savings compared to the use of NSAIDs by non-PT PCMs. Decreased use of NSAIDs could have resulted in decreased adverse drug effects as well.

Cost of Care

For costs of visits, MSK patients seeing PTs in the role of PCM had a significantly lower cost of care per visit than MSK patients seeing MDs, DOs, Pas, and ARNPs in the PCM role, by mean differences of -106.56, -51.15, -100.62, and -99.53 respectively.

On average, cost of military and civilian medical care provided to patients with MSK disorders by PTs acting as the PCM was half that of the cost of care provided to patients with MSK disorders by MDs, DOs, PAs, and ARNPs acting as the PCM. [174,175]

Return to Work

Patients had a significantly greater number of visits when MDs served as PCMs than when PT served as the PCM. However, no significant differences were reported in number of visits among all PCM types when hierarchical linear regression controlled for demographics and for patient characteristics and comorbidities. Yet, prior to controlling for effects of individual variables, post hoc results using Tukey's Statistics of Differences revealed that when patients with MSK conditions saw MDs as their PCM, they had a significantly more visits before discharge than patients with MSK conditions who saw PTs as their PCM, by a mean difference of 0.17. Number of visits and then discharge were used as return to work criteria. The military electronic health record (AHLTA) did not allow access to time based data that would allow analysis of time from initial evaluation to discharge. Limitation of data to number of visits only did allow for cost per visit to be calculated. As a consequence, it was not possible to determine if PTs where able to return patients to work quicker than other non-PT PCMs.

Implications for PT Practice

Physical therapists do not have the same liability concerns that traditional PCMs do. A 2010 study reported that 91% of physicians practice defensive medicine, ordering more tests and procedures than necessary to help protect themselves from lawsuits.[176] The study asked physicians to agree or disagree with two questions in order to rate the physicians level of agreement: (a) Doctors order more tests and procedures than patients need for [legal] protection; and (b) without tort reform, unnecessary diagnostic testing will not decrease. An overwhelming 91% of physicians agreed with both statements. ARNPs and PAs who practice as front-line providers face the same litigation pressures that physicians face. Liability concerns and self-protection are deeply imbedded in the didactic training and clinical residencies of these non-PT PCM categories. Military PTs who serve as front-line providers are much less likely to face law suits because of the protection provided by the 1940 Federal Torts Claims Act.[177]

Limitations and Future Research

A technician from the Air Force Medical Service Analytics branch pulled all data from AHLTA's the military electronic health records (EHRs). No free-text, narrative content was analyzed. The ability to determine whether providers documented use of any form of radiology clinical practice guidelines prior to ordering x-rays was not available. EHRs that are newer than AHLTA contain numerous workflow checks that help providers make clinical decisions. The new military EHR by CERNER has drop-down boxes that contain imaging CPGs for multiple conditions. Data mining in these new EHRs will provide a much-improved picture of patient care. The limitations in AHLTA restricts interpretation of the data to a yes or no answer regarding x-ray use and does not consider the PCM's clinical decision making. Initial patient pain rating was higher in the PT PCM group and x-ray use was lower. The RTW rate was

statistically insignificant among all groups. Non-PT PCM radiology results were not available to determine whether patients had a finding on x-ray that related to their MSK complaints. The examination of usage frequency and documentation of current radiology clinical practice guidelines could be an area of future research.

The study was conducted at one Air Force military treatment facility, examining the practice patterns of two PTs, two PAs, one ARNP, two MDs, and three DOs. Generalization to the other practice settings would be limited. However, results support the value of additional research in practice settings where cost and patient outcomes of PCMs versus PTs can be compared. Kaiser Permanente allows direct access for PTs with the ability to order imaging, making that an ideal practice setting for conducting a civilian sector follow-up study comparing PT PCM's to non-PT PCMs. Wisconsin is the first state to allow PTs to order imaging studies – an effort that should be assessed to hopefully lend support for similar measures to be pushed to other states. The American Physical Therapy Association is supportive of efforts – such as granting imaging privileges – to assist with autonomous PT practice.

Finally, there is no evidence to support the conclusion that PTs provide less expensive care in the long-term. The possibility exists that as payers and patients acclimate to PTs serving as entry point providers, cost may temporarily mirror that of other non-PT PCMs. Even if this is the case, it could be argued that patients would receive the most competent, non-operative care for MSK conditions from PTs.

Conclusions

Physical therapists are now educated at the clinical doctorate level, and categorized as non-physician providers (NPPs). Doctoral PT programs provide educational content regarding radiology, pharmacology, laboratory, differential diagnostic measures, and clinical decision similar to the educational content provided for other NPPs such as podiatrist, chiropractors, optometrists, and ARNPs. These NPPs practice without physician oversight, with the scope of practice for each NPP determined by state practice acts.

This study, which examined the military model of physical therapy practice compared to the traditional PCM model, supported the ability of PTs to provide care for patients with MSK disorders at lower overall cost and using less imaging and medication. PTs showed RTW rates similar to those of traditional PCM's. I am one of the two PTs who participated in the study. I'm an active-duty Air Force PT with 20 years of experience in outpatient orthopedics. I am a graduate of the McKenzie Diploma program, and an APTA clinical specialist in sports. I completed all Air Force requirements for autonomous practice mentioned in previous chapters. The second PT is a civilian with no prior military service, 24 years of experience in outpatient orthopedics, a tDPT degree and with an APTA clinical specialty in orthopedics. The civilian PT was required to train under the supervision of an MD for one year to be considered for prescription and imaging privileges. Medical records of 100 patients, who were either prescribed medication or had imaging studies ordered, were reviewed for appropriateness and clinical indicators that would support medication and/or imaging use. Until civilian PTs can prescribe certain medications and ordering imaging studies during their DPT program clinical rotations, an MD preceptor is an alternative to help bridge the gap. State PT practice acts must be altered to allow civilian PTs to practice up to their full educational potential.

Physical therapy is an essential component of healthcare worldwide. All 50 states have some form of direct access to PT care. The next logical step for PTs in the United States is to transition to a practice model comparable to that of military PTs, who are credentialed to order certain medications, imaging studies, and laboratory tests, and to practice independently. This practice model has been shown to be safe and effective, and is also a demonstrated means of containing costs. Physical therapists are highly trained medical providers who can contribute great value to the team of other PCMs who serve patients as entry point providers.

References

1. Gardner K. Direct access to physical therapy services: Overview. 2015. http://www.apta.org/StateIssues/DirectAccess/ Overview/. Accessed September 7, 2015.

2. Air Force Instruction. *Clinical performance improvement.* 2001. http://www.af.mil/. Accessed September 7, 2015.

3. Army-Baylor DPT Graduate School. http://www.baylor.edu/graduate/pt/index.php?id=28285. Accessed September 7, 2015.

4. American Physical Therapy Association. *Today's physical therapist: A comprehensive review of a 21st-century health care profession*. 2011. https://www.apta.org/uploadedFiles/APTAorg/Practice_and_Patient_Care/PR_and_Marketing/Market_to_Professionals/TodaysPhysicalTherapist.pdf. Accessed September 7, 2015.

5. Duke University. *Mission statement*. 2016. https://dpt.duhs.duke.edu/. Accessed September 7, 2015.

6. Colwill JM, Cultice JM, Kruse RL. Will generalist physician supply meet demands of an increasing and aging population? Health Affairs. 2008;27(3): 232–241. doi:org/10.1377/hlthaff.27.3.w232

7. *Dill M., Salsberg E. HHS in the 21st century: Charting a new course for a healthier America. 2008a. http://iom.nationalacademies.org/~/media/Files/Report%20Files/2008/HHS-in-the-21st-Century-Charting-a-New-Course-for-a-Healthier-America/HHS%20report%20brief%20final.pdf.* Accessed June 9, 2016.

8. Dill M, Salsberg E. (2008b) *The complexities of physician supply and demand: Projections through 2025*. 2008b. https://members.aamc.org/eweb/upload/The%20Complexities%20of%20Physician%20Supply.pdf. Accessed June 9, 2016.

9. Deyle GD. Direct access physical therapy and diagnostic responsibility: The risk-to-benefit ratio. Journal of Orthopaedic & Sports Physical Therapy. 2006;36(9):632–634. doi: org/10.2519/jospt.2006.0110

10. McCallum CA, Di Angelis T. Direct access: Factors that affect physical therapist practice in the state of Ohio. Physical Therapy. 2012;92(5):688–706. doi: org/10.2522/ptj.20100358

11. Muller LS. Direct access - The best kept secret: A "seasoned" case manager learns from personal experience. Professional Case Management. 2007;12(3):170–177. doi:org/10.1097/01.PCAMA.0000271368.85923.af

12. Shoemaker MJ. Direct consumer access to physical therapy in Michigan: Challenges to policy adoption. Physical Therapy. 2012;92(2):236–250. doi: org/10.2522 /ptj.20100421

13. Anderson JG, Nemes, J. Lessons from other fields can help audiology complete its transformation. *The Hearing Journal.* 2004;57(10):28–32. doi:10.1097/NHH .0000000000000303.

14. American Physical Therapy Association. Indiana enacts direct access: Direct PT evaluation now in all 50 states + DC. *PT in Motion News.* 2013. http://www.apta.org/PTinMotion/ NewsNow/2013/4/30/Indiana/. Accessed September 8, 2015.

15. Commission on Accreditation in Physical Therapy Education. Evaluative criteria PT programs. http://www.capte Commission on Accreditation in Physical Therapy Education. http://www.capteonline.org/home.aspx. Updated August 7, 2014. Accessed September 7, 2015.

16. Gleeson P, Gwyer J. Education section, APTA. *Journal of PT Education.* 2006;20(2):68–77. doi: 10.1097/BRS.0000000000001446.

17. Bellamy J. *Vision statement for the physical therapy profession and guiding principles to achieve the vision.* 2013. http://www.apta.org/Vision/. Accessed September 7, 2015.

18. Childs JD, Whitman JM, Pugia ML, et al. Knowledge in managing musculoskeletal conditions and educational preparation of physical therapists in the uniformed services. *Military Medicine.* 2007;172(4):440–445. doi:org /10.7205 /MILMED.172.4.440

19. Moore JH, Goss DL, Baxter RE, et al. Clinical diagnostic accuracy and magnetic resonance imaging of patients referred by physical therapists, orthopedic surgeons, and orthopedic providers. *Journal of Orthopedic & Sports Physical Therapy.* 2005;35(2):67–71. doi:org/10.2519/jospt .2005.35.10.674

20. McGill T. Effectiveness of physical therapists serving as primary care musculoskeletal providers as compared to family practice providers in a deployed combat location: A retrospective medical chart review. *Military Medicine.* 2013;178(10):1115–1120. doi:org/10.7205/MILMED-D-13-00066

21. Pendergast J, Kliethermes SA, Freburger JK, et al. A comparison of health care use for physician-referred and self-referred episodes of outpatient physical therapy. *Health Services Research.* 2012;47(2):633–654. doi:org/10.1111/j.1475-6773.2011.

22. Stevans JM, Bise CG, McGee JC, et al. Evidence-based practice implementation: Case report of the evolution of a quality improvement program in a multicenter physical therapy organization. *Physical Therapy. 2015;*2(10). doi: 10.2522/ptj.20130541

23. A summary of Direct Access to Physical Therapy services in the United States. American Physical Therapy Association. 2016. https://www.apta.org/uploadedFiles/APTAorg /Advocacy/State/Issues/Direct Access/DirectAccessbyState.pdf. Accessed September 18, 2015.

24. Boissonnault WG, Ross MD. Physical therapists referring patients to physicians: A review of case reports and series. *Journal of Orthopaedic & Sports Physical Therapy.* 2012;42(5):446–454. doi:org/10.2519/jospt.2012.3890

25. Garber MB. Diagnostic imaging and differential diagnosis in 2 case reports. *Journal of Orthopaedic & Sports Physical Therapy.* 2005;35(11):745–754. doi: 10.2519/jospt.2005.2087

26. Benson CJ, Schreck RC, Underwood FB, et al. The role of Army physical therapists as non-physician health care providers who prescribe certain medications: Observations and experiences. *Physical Therapy.* 1995;75(5):380 – 386. doi:10.2519 /jospt.2011.3556

27. Segal DR, Segal MW. America's military population. *Population Bulletin.* 2004;59(4). http://www.deomi.org/contribute/DiversityMgmt/documents/AmericasMilitaryPopulation2004.pdf

28. Ellis RP, McGuire TG. Optimal payment systems for health services. *Journal of Health Economics.* 1990;9(4):375–396. http://doi.org/10.1016/0167-6296(90)90001-J

29. Marchand K, Jablecki N. The physical therapy prescription. *American Family Physician.* 2007;1(76):1661 – 1666. doi: 10.1016/j.mcna.2014.03.009

30. Matzkin E, Smith MEL, Freccero CD, et al. Adequacy of education in musculoskeletal medicine. *The Journal of Bone & Joint Surgery.* 2005;87(2):310 – 314. http://doi.org/10.2106/JBJS.D.01779

31. Schmale GA. More evidence of educational inadequacies in musculoskeletal medicine: *Clinical Orthopedics and Related Research.* (437):251 – 259. doi: org/10.1097/01.blo.0000164497.51069.d9

32. Chehade M, Burgess T, Bernstein J, et al. Musculoskeletal education initiatives and the bone and joint decade. *US Musculoskeletal Review.* 2008;3(2):86 – 87. doi:10.1002/art.23001

33. Matheny JM, Brinker MR, Elliott MN, et al. Confidence of graduating family practice residents in their management of musculoskeletal conditions. *American Journal of Orthopedics.* 2000;29(12):945 – 952. doi: 10.1007/s11845-008-0153

34. Lebec MT, Jogodka CE. The physical therapist as a musculoskeletal specialist in the emergency department. *Journal of Orthopaedic & Sports Physical Therapy.* 2009;39(3):221 – 229. doi: 10.1007/s11606-011-1965-5

35. Andrus B. Seven direct access myths debunked. 2014. https://www.webpt.com/blog/post/7-direct-access-myths-debunked. Accessed September 7, 2015.

36. Freedman KB, Bernstein J. The adequacy of medical school education in musculoskeletal medicine. *Journal of Bone Joint Surgery America.* 1998;80(10):1421 – 1427. doi:10.7556/jaoa.2016.091.

37. Fuhrmans V. Withdrawal treatment: a novel plan helps hospital wean itself off pricey tests. *The Wall Street Journal*. January 12, 2007. http://www.trentsalo.com/uploads/1/3/0/5/13051674/anovelplanhelpshospitalweanitselfoffofpriceytests.pdf. Accessed September 7, 2015.

38. New Choice Health. Insights from New Choice Health. June 19, 2005. https://www.newchoicehealth.com/Insights/. Accessed September 7, 2015.

39. GoodRx. Stop paying too much for prescriptions. 2016. http://www.goodrx.com/. Accessed September 7, 2015.

40. GlassDoor. Air Force salary. November 12, 2016. https://www.glassdoor.com/Salary/US-Air-Force-Salaries-E41283.htm. Accessed September 7, 2015.

41. Guidedoc.com. *Physical rehabilitation*. 2016. http://guidedoc.com/physical-rehabilitation. Accessed September 7, 2015.

42. Schieber S. The unsustainable cost of health care. *Social Security Advisory Board*. 2009. www.clouddx.com/downloads/TheUnsustainableCostofHealth care.pdf. Accessed September 7, 2015.

43. Heffler S. Health spending projections through 2013. *Health Affairs. 2004;*79(4).

44. Keehan SP, Cuckler GA, Sisko et al. National health expenditure projections, 2014–24: Spending growth faster than recent trends. *Health Affairs. 2015;*34(8):1407 - 1417. doi: 10.1377/hlthaff.2015

45. Isaacs S, Jellinek P. Accept no substitute: A report on scope of practice. *The Physicians Foundation,* 2012:1–73. doi: 10.1155/2012/671974

46. Davenport TE, Sebelski CA. The physical therapist as a diagnostician: How do we, should we, and could we use information about pathology in our practice? *Physical Therapy. 2011;*91(11):1694–1695. doi:10.2522/ptj.2011.91.11.1694

47. Childs JD, Whitman, JM, Sizer PS, et al. A description of physical therapists' knowledge in managing musculoskeletal conditions. *BMC Musculoskeletal Disorders.* 2005;6(1):32.

48. Ross MD, Childs JD, Middel C, et al. Physical therapist vs. family practitioner knowledge of simple low back pain management in the U.S. Air Force. *Military Medicine.* 2014;179(2):162–168. doi: org/10.7205 /MILMED-D-13-00099

49. Ziemke G, Koffman R, Wood DP. "Tip of the spear" physical therapy during a 6-month deployment to the Persian Gulf: A preliminary report. *Military Medicine.* 2001;166(6):505. doi: 10.1097/BOR.0b013e3283503406

50. World Confederation for Physical Therapy. Scope of practice. October 11, 2016. http://www.wcpt.org/node/29535. Accessed September 7, 2015.

51. DiCaprio MR, Covey A, Bernstein J. Curricular requirements for musculoskeletal medicine in American medical schools. *The Journal of Bone & Joint Surgery. 2003;*85(3):565–567. doi: 10.1186/1471-2474-13-107

52. American Association of Colleges of Osteopathic Medicine. http://www.aacom.org /reports-programs-initiatives/aacom-reports/curriculum. Accessed November 4, 2016.

53. American Board of Internal Medicine Physician Certification. Internal medicine policies. http://www.abim.org/certification/policies/imss/im.aspx. Accessed September 7, 2015.

54. Day CS, Yeh AC, Franko O, et al. Musculoskeletal medicine: An assessment of the attitudes and knowledge of medical students at Harvard Medical School: *Academic Medicine.* 2007;82(5):452–457. doi:org/10.1097/ ACM.0b013e31803ea860

55. Rosenberg AA, Kamin C, Glicken AD, et al. Training gaps for pediatric residents planning a career in primary care: A qualitative and quantitative study. *Journal of Graduate Medical Education.* 2011;3(3):309–314.

56. Hollinghurst S, Horrocks S, Anderson E, et al. Comparing the cost of nurse practitioners and GPs in primary care: Modelling economic data from randomized trials. *The British Journal of General Practice: The Journal of the Royal College of General Practitioners.* 2006;56(528):530–535. doi:10.1136/bmj.324.7341.819.

57. Kraft SP. A practical approach to vertical strabismus: it is not a 'black box!' original article. *South African Ophthalmology Journal. 2016;*11(3):12- 16. doi: 10.3389/fnint.2014.00071

58. Robinson A. *The last man who knew everything.* London, UK: Oneworld Publications; 1997.

59. Iglehart JK. Health insurers and medical-imaging policy—a work in progress. *New England Journal of Medicine.* 2009;360(10):1030 - 1037. doi: 10.1056/NEJMhpr080870

60. Sklar DP. How many doctors will we need? A special issue on the physician workforce. *Academic Medicine.* 2013;88(12):1785 - 1787. doi: 10.1097/ACM.0000000000000030

61. Bauer JC. Nurse practitioners as an underutilized resource for health reform: Evidence-based demonstrations of cost-effectiveness. *Journal of the American Academy of Nurse Practitioners.* 2010;22(4):228–231.

62. New Wisconsin Law Allows PTs to Order X-Rays. *PT in Motion News.* April 25, 2016. http://www.apta.org/PTinMotion/News/2016/4/25/WisconsinXRays/. Accessed November 4, 2016.

63. Rhon DI, Gill N, Teyhen D, et al. Clinician perception of the impact of deployed physical therapists as physician extenders in a combat environment. *Military Medicine.* 2010;175(5):305–312.

64. Flexner A, Pritchet H, Henry S. Medical education in the United States and Canada bulletin number four (The Flexner Report). New York, NY: The Carnegie Foundation for the Advancement of Teaching; 1910.

65. Cooke M, Irby DM, Sullivan W, et al. American medical education 100 years after the Flexner report. *New England Journal of Medicine.* 2006;355(13):1339-44.

66. Desmeules F, Roy JS, MacDermid JC, et al. Advanced practice physiotherapy in patients with musculoskeletal disorders: A systematic review. *BMC Musculoskeletal Disorders.* 2012;13(1):1.

67. Cooper RA, Getzen TE, McKee HJ, et al. Economic and demographic trends signal an impending physician shortage. *Health Affairs.* 2002;21(1):140-154.

68. Graduate Medical Education National Advisory Committee. Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health and Human Services. 2002.

69. Tarlov AR. Estimating physician workforce requirements: the devil is in the assumptions. *Journal of the American Medical Association.* 1995;274(19):1558-1560.

70. Petterson SM, Liaw WR, Phillips RL, Rabin DL, Meyers DS, Bazemore AW. Projecting US primary care physician workforce needs: 2010-2025. *The Annals of Family Medicine.* 2012;10(6):503-509.

71. Porter S. 52,000 More primary care physicians needed by 2025. November 14, 2012. http://www.aafp.org/news/practice-professional-issues/ 20121114workforceneeds.html. Accessed September 7, 2015.

72. Cantlupe J. Bundled payments come to cancer care. *Health Leaders Media.* 2013;11.

73. American Medical Association (AMA). AMA scope of practice data series: Nurse practitioners. Chicago, IL: American Medical Association; 2013.

74. Hackbarth AD. Eliminating waste in U.S. health care. *Journal of American Medical Association.* 2012;307(14):1513.

75. Johnson PJ, Ghildayal N, Ward AC, Westgard BC, Boland LL, Hokanson JS. Disparities in potentially avoidable emergency department (ED) care: ED visits for ambulatory care sensitive conditions. *Medical care.* 2012;50(12):1020-1028.

76. Pollak A, Watkins-Castillo S. Health care treatment visits for musculoskeletal injuries. The Burden of Musculoskeletal diseases in the United States Web site. 2012. http://www.boneandjointburden.org/2014-report/via21/health-care-treatment-visits-musculoskeletal-injuries. Accessed September 7, 2015.

77. Gruchy A, Granger C, Gorelik A. Physical therapists as primary practitioners in the emergency department: Six-month prospective practice analysis. *Physical Therapy. 2015;*95(9):1207–1216.

78. Bieck AD, Biggs WS, Crosley PW, Kozakowski SM. Results of the 2012 National Resident Matching Program: family medicine. *Family Medicine.* 2012;44(9):615-619.

79. Health Care Association of New York. *News.* 2013. https://www.hanys.org/news/. Accessed June 9, 2016.

80. Assistant Secretary for Public Affairs. The affordable care act is working. June 24, 2015. http://www.hhs.gov/ healthcare/facts-and-features/fact-sheets/aca-is-working/index.html. Accessed September 7, 2015.

81. Urgent Care Association of America. 2016. https://ucaoa.site-ym.com/?UCMC. Accessed September 7, 2015.

82. American Academy of Family Physicians. Primary care for the 21st century; Ensuring a quality, physician-led team for every patient. September 18, 2012. http://www.aafp.org /dam/AAFP/documents/ about us/initiatives/AAFP-PCMHWhitePaper.pdf?cmpid =npp12_ad_com_na_van_1. Accessed October 7, 2015.

83. Donato EB, DuVall RE, Godges JJ, Zimmerman GJ, Greathouse DG. Practice analysis: defining the clinical practice of primary contact physical therapy. *Journal of Orthopaedic & Sports Physical Therapy.* 2004;34(6):284-304. doi: org/10.2519/jospt.2004 .34.6.284

84. Mundinger MO, Kane RL, Lenz ER, et al. Primary care outcomes in patients treated by nurse practitioners or physicians: a randomized trial. *Journal of the American Medical Association* 2000;*283*(1):59-68. doi:10.1001/jama.283.1.59

85. Grella R. *Direct access: Where's the risk? Uncovering the truth behind the persistent "public safety" myth*. November 12, 2013. http://physical-therapy.advanceweb.com /Archives/Article-Archives/Direct-Access-Wheres-The-Risk.aspx. Accessed September 7, 2015.

86. Miller K. Nurse Practitioners: Future gatekeepers for primary care. *The Journal for Nurse Practitioners.* 2006;2(8):496. doi:org/10.1016/j.nurpra.2006.07.003

87. Staton FS, Bhosle MJ, Camacho FT, Feldman SR, Balkrishnan R. How PAs improve access to care for the underserved. *Journal of the American Academy of Physician Assistants.* 2007;20(6):32-7. http://journals.lww.com/jaapa/Fulltext/2007/06000/How_PAs_improve_access_to_care_for_the_underserved.8.aspx

88. Zwijnenberg NC, Bours G J. Nurse practitioners and physician assistants in Dutch hospitals: their role, extent of substitution and facilitators and barriers experienced in the reallocation of tasks. *Journal of Advanced Nursing.* 2012;68(6):1235-1246. doi:org /10.1111/j.1365-2648.2011.05823.x

89. Cipher DJ, Hooker RS, Sekscenski E. Are older patients satisfied with physician assistants and nurse practitioners? *Journal of the American Academy of Physician Assistants.* 2002;19(1):36-39. http://journals.lww.com/jaapa/Fulltext/2006/01000/Are_older_patients_satisfied_with_physician.7.aspx

90. Mitchell JM, de Lissovoy GA. Comparison of resource use and cost in direct access versus physician referral episodes of physical therapy. *Physical therapy.* 1997;77(1):10-18. doi: 10.2522/ptj.20130096

91. Mullan F, Epstein L. Community-oriented primary care: new relevance in a changing world. *American Journal of Public Health.* 2002;92(11):1748-1755. doi: org/10 .4102

92. Feldman SR, Fleischer AB, Chen JG. The gatekeeper model is inefficient for the delivery of dermatologic services. *Journal of the American Academy of Dermatology.* 1999;40(3):426-432. doi: org/10.1016/S0190-9622(99)70492-5

93. NY State Society of Orthopedic Surgeons. Are you trained to recognize the bone tumor in the lower back? *The Legislative Gazette.2000;*22:5.

94. Boissonnault W, Goodman C. Physical therapists as diagnosticians: drawing the line on diagnosing pathology. *Journal of Orthopaedic & Sports Physical Therapy.* 2006;36(6):351-353. doi: 10.2519/jospt.2006.0107

95. Henschke N, Maher CG, Ostelo RW, de Vet HC, Macaskill P, Irwig L. Red flags to screen for malignancy in patients with low□back pain. *The Cochrane Library.* 2013. doi:org/10.1136/bmj.f7095

96. Leerar PJ, Boissonnault W, Domholdt E, Roddey T. Documentation of red flags by physical therapists for patients with low back pain. *Journal of Manual and Manipulative Therapy.* 2007;15(1):42-49. doi: 10.1179/jmt.2007.15.2.42E

97. American Association of Physician Assistants. History of the PA Profession. https://www.aapa.org/threeColumnLanding.aspx?id=429. Accessed September 7, 2015.

98. ARC-PA. *Standards of accreditation.* March 2016. http://www.arc-pa.org/accreditation. Accessed September 7, 2015.

99. Hooker RS. Federally employed physician assistants. *Military Medicine,* 2008;173(9):895–899. doi:org/10.7205/MILMED.173.9.895

100. Salyer S. Continued growth for military PAs. *Journal of American Academy of Physician Assistants.* 2002:15(10):35–39. doi: 10.1080/00045600801922422

101. Cornell S. *PAs and the U.S. military.* May 1, 2008. http://nurse-practitioners-and-physician-assistants.advanceweb.com/Article/PAs-and-the-US-Military.aspx. Accessed September 7, 2015.

102. Counselman FL, Graffeo, CA, Hill JT. Patient satisfaction with physician assistants (PAs) in an ED fast track. *The American Journal of Emergency Medicine.* 2000;18(6):661–665. doi: org/10.1053/ajem.2000.16301

103. Hooker RS, Everett CM. The contributions of physician assistants in primary care systems. *Health & Social Care in the Community.* 2012;20(1):20 - 31. doi: 10.1111 /j.1365-2524.2011. 01021.x

104. American Academy of Physicians Assistants. May 3, 2016. https://www.veteranscaucus.org/. Accessed September 7, 2015.

105. Killeen PE. Do the physician assistants in your hospital have a voice? *Journal of the American Academy of Physician Assistants.* 2009;22(1):13. doi: 10.1007/s11606-011-1965-5

106. Schuer KM. A niche for PAs to effect change in our health care system. *Journal of the American Academy of Physician Assistants.* 2009;22(8):10. doi: 10.1097/01720610-200908000-00002

107. Halter M, Drennan V, Chattopadhyay K, et al. The contribution of physician assistants in primary care: a systematic review. *BMC Health Services Research.* 2013;13(1):1. doi: 10.1186/1472–6963–13–223

108. Van den Driesschen Q, de Roo F. Physician assistants in the Netherlands. *Journal of the American Academy of Physician Assistants.* 2014;27(9):10-11. doi: org 10.1097 /01.JAA.0000453240.00098.83

109. Bruijn□Geraets D, Daisy P, Eijk-Hustings V, Yvonne JL, Vrijhoef HJ. Evaluating newly acquired authority of nurse practitioners and physician assistants for reserved medical procedures in the Netherlands: a study protocol. *Journal of Advanced Nursing.* 2014;70(11):2673-2682. doi:org/10.1111/jan.12396

110. Creswell JW, Klassen AC, Plano-Clark VL, Smith KC. *Best practices for mixed methods research in the health sciences.* Bethesda, MD: National Institutes of Health; 2011.

111. Sahotsky B. *Masons, Materials, and Machinery: Logistical Challenges in Roman Building*. [Dissertation]. http://www.sas.upenn.edu/ancient/masons/Sahotsky-Masons_Materials.pdf. Philadelphia: University of Pennsylvania; 2016.

112. American Association for the History of Nursing. 2007. https://www.aahn.org/. Accessed September 7, 2015.

113. Goertz R. Nurse practitioners no substitute for physician-led team. *American Academy of Family Physicians: Leader Voices.* September 19, 2012. http://blogs.aafp.org/cfr /leadervoices/entry/ nps_no_substitute_for_physician. Accessed September 7, 2015.

114. Fairman J, Rowe J, Hassmiller S, Shalala D. Broadening the scope of nursing practice. *The New England Journal of Medicine.* 2011;364(3):193–197. doi: 10.1056 /NEJMp101212

115. American Association of Nurse Practitioners. *Clinical outcomes: The yardstick of educational effectiveness.* https://www.aanp.org/images/documents/publications /clinicaloutcomesyardstick.pdf. Accessed September 7, 2015.

116. Yin S. American Medical Association: Nurses aren't our equals. http://www.fiercehealth care.com/story/ama-nurses-arent-our-equals/2010-10-06. Accessed September 7, 2015.

117. Nyberg SM, Keuter KR, Berg GM, Helton AM, Johnston AD. A national survey: Acceptance of physician assistants and nurse practitioners in trauma centers. *Journal of the American Academy of Physician Assistants.* 2010;23(1):35-41. http://journals .lww.com/jaapa/Fulltext/2010/01000/ A_national_survey__Acceptance_of _physician.9.aspx

118. Scheffler RM, Liu JX, Kinfu Y, Dal Poz MR. Forecasting the global shortage of physicians: an economic-and need-based approach. *Bulletin of the World Health Organization.* 2008;86(7):516-523. doi:org/10.2471/BLT.07.046474

119. The Associated Press. Florida nurses fight for ability to issue prescriptions. *The Gainesville Sun*. 2009. http://www.gainesville.com/article/ 20090304/ ARTICLES/903040984. Accessed March 5, 2014.

120. O'Brien JM. How nurse practitioners obtained provider status: lessons for pharmacists. *American Journal of Health-System Pharmacy.* 2003;60(22):2301-2307. http://www.medscape.com/viewarticle/464663

121. Brassard A. The campaign for action: an update. *The American Journal of Nursing,* 2012;113(3):48-51. http://www.rwjf.org/en/library/research/2013/03/ the-campaign-for-action--an-update.html

122. Smith CL. *Physician extenders, their current and future role in medical care delivery*. U.S. Congress, Congressional Budget Office: for sale by the Supt. of Docs., U.S. Government. Printing Office. 1979. https://www.cbo.gov/sites/default/files/96th-congress-1979-1980/ reports/79doc633.pdf

123. Horrocks S, Anderson E, Salisbury C. Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors. The *BMJ.* 2002;324(7341):819 - 823. doi:org/10.1136/bmj.324.7341.819

124. Boodman SG. Medical school done faster. *The Washington Post.* January 13, 2014. https://www.washingtonpost.com/national/health-science/medical-school-done-faster/2014/01/13/4b6d9e54-5c40-11e3-be07-006c776266ed_story.html. Accessed September 7, 2015.

125. Irby DM, Cooke M, O'Brien BC. Calls for reform of medical education by the Carnegie Foundation for the Advancement of Teaching: 1910 and 2010. *Academic Medicine,* 2010;85(2):220-227. doi: org/10.1097/ACM.0b013e3181c88449

126. Mapp JW. *The Civil War: The origins of veterans' health care--Veterans Health Administration general information.* November 1, 2015. http://www.va.gov/health/NewsFeatures/20110413a.asp. Accessed June 12, 2015.

127. National Park Service. 2015. https://www.nps.gov/nr/travel/veterans_affairs/History.html. Accessed June 2015.

128. Nicholson S. *The physical therapist's business practice, and legal guide*. Sudbury, MA: Jones and Bartlett; 2008.

129. Schleichkorn J. The origin of a tradition. November 1, 2015. http://physical-therapy.advanceweb.com/Article/The-Origin-of-a-Tradition.aspx. Accessed September 7, 2015.

130. Vietnam Women's Memorial Fund. Vietnam Women's Memorial. *2016.* http://www.vietnamwomensmemorial.org/index2.php. Accessed September 7, 2015.

131. Greathouse DG, Schreck RC, Benson CJ. The United States Army physical therapy experience: evaluation and treatment of patients with neuromusculoskeletal disorders. *Journal of Orthopaedic & Sports Physical Therapy.* 1995;19(5):261-266. doi: 10.2519/jospt.2011.3556

132. Dorrance KA, Ramchandani S, LaRochelle J, Mael F, Lynch S, Grundy P. Protecting the culture of a patient-centered medical home. *Military medicine.* 2013;178(2):153-158. doi: org/10.7205/MILMED-D-12-00146

133. Murray, P. *Military construction. Renovation plans for at the Ports Smith Naval Medical Center.* 1997. http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix= html &identifier=ADA326914. Accessed September 7, 2015.

134. Jette DU, Ardleigh K, Chandler K, McShea L. Decision-making ability of physical therapists: physical therapy intervention or medical referral. *Physical Therapy.* 2006;86(12):1619-1629. doi: org/10.2522/ptj.20050393

135. United Kingdom's Chartered Society of Physiotherapy. 2016. http://www.csp.org.uk/. Accessed September 7, 2015.

136. Health Professions Council. *Physiotherapy Standards of Efficiency.* May 28, 2013. http://www.hpc-uk.org/assets/documents/10000dbcstandards_of_proficiency _physiotherapists.pdf. Accessed May 17, 2014.

137. National Health Service. *Physiotherapist.* https://www.health careers.nhs.uk/explore-roles/allied-health-professionals/ physiotherapist. Accessed September 7, 2015.

138. Gray P. Independent prescribing gets legal green light. May 28, 2013. http://www.csp.org .uk/news/2013/08/20/independent-prescribing-gets-legal-green-light. Accessed May 13, 2015.

139. Global Alliance for Musculoskeletal Health. Bone and Joint Decade. October 15, 2015. http://bjdonline.org/. Accessed September 7, 2015.

140. Grunfeld R, Banks S, Fox E, Levy BA, Craig C, Black K. An assessment of musculoskeletal knowledge in graduating medical and physician assistant students and

implications for musculoskeletal care providers. *Journal of Bone and Joint Surgery. 2012;*94(4):343-348. doi: org/10.2106/JBJS.J.00417

141. Cohen J. *Statistical power analysis for the behavioral sciences* (2nd ed.), New Jersey: Lawrence Erlbaum Associates; 1988.

142. Cowles M, Davis C. On the origins of the .05 level of statistical significance. *American Psychologist, 1982;*37(5):553-558. doi: org/10.1037/0003-066X.37.5.553

143. RAND Corporation. http://www.rand.org/. Accessed July 5, 2016.

144. American Physical Therapy Association. The task force on strategic plan to achieve vision 2020; a vision statement for physical therapy 2020. Working operational definitions of elements of vision 2020. 2008. http://www.apta.org/Vision2020/. Accessed July 5, 2016.

145. Advance Health Care Network. Top 10 DPT programs in the U.S. March 22, 2012. Advance Health Care Network web site. http://physical-therapy.advanceweb.com/Web-Extras/Top-10-Lists/Top-10-Physical-Therapy-Schools.aspx. Accessed Sept 15, 2016.

146. Jones BH, Canham-Chervak M, Canada S, Mitchener TA, Moore S. Medical Surveillance of Injuries in the U.S. Military. *American Journal of Preventive Medicine.* 2010;38(1S):S42–S60.

147. Belmont PJ, Schoenfeld AJ, Goodman G. Epidemiology of combat wounds in Operation Iraqi Freedom and Operation Enduring Freedom: Orthopedic burden of disease. *Journal of Surgical Orthopaedic Advances.* 2010; 19(1),2-7.

148. Cohen, J. A power primer. *Psychological Bulletin.* 1992;112:155-159.

149. American Physical Therapy Association. Direct access at the state level. http://www.apta.org/StateIssues/DirectAccess/Overview/. Accessed July 7, 2017.

150. World Confederation for Physical Therapy. Policy statement: Description of physical therapy. London, UK, WCPT; 2017.

151. Studdert DM, Mello MM, Sage WM. Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *Journal of the American Medical Association.* 2005;293:2609–2617152.

152. Bautista AB, Burgos A, Nickel BJ, Yoon JJ, Tilara AA, Amorosa JK. Do clinicians use the American College of Radiology Appropriateness Criteria in the management of their patients? *American Journal of Roentgenology.* 2009;192:1581-1585.

153. Bettmann M. The ACR appropriateness criteria: view from the committee chair. *Journal of the American College of Radiology.* 2006;3:510–512

154. Hillman BJ, Goldsmith J. Imaging: the self-referral boom and the ongoing search for effective policies to contain it. *Health Affairs. 2010;*29:2231-2236.

155. Hillman BJ, Goldsmith JC. The uncritical use of high-tech medical imaging. *New England Journal of Medicine. 2010.* 363:4-6.

156. U.S. Congress, Medicare Payment Advisory Commission. Report to the Congress: Medicare and the Health Care Delivery System. 2011. http://medpac.gov/docs/default-source/reports/Jun11_EntireReport.pdf. Accessed 8 July 2015.

157. Boissonnault WG, Ross MD. Physical Therapists Referring Patients to Physicians: A Review of Case Reports and Series. *Journal of Orthopedic and Sports Physical Therapy. 2010;*42(5): 446-454.

158. Moore JH, McMillian DJ, Rosenthal MD, Weishaar, MD. Risk determination for patients with direct access to physical therapy in military health care facilities. *Journal of Orthopaedic and Sports Physical Therapy. 2005;*35:674-678.

159. Moore JH, Goss DL, Baxter RE, et al. Clinical diagnostic accuracy and magnetic resonance imaging of patients referred by physical therapists, orthopedic surgeons, and non-orthopedic providers. *Journal of Orthopaedic and Sports Physical Therapy;* 2005;35:67-71.

160. Murphy BP, Greathouse D, Matsui I. Primary care physical therapy practice models. *Journal of Orthopaedic and Sports Physical Therapy.* 2005;35:699-707.

161. Wisconsin State Legislature, Assembly Bill 549. April 26, 2016. http://docs.legis.wisconsin.gov/2015/proposals/ab549. Accessed 16 July 2017.

162. Dominiczak L, Schick K. Advancing scope of practice – Physical Therapists ordering X-rays in Wisconsin. 2016 Federation of State Boards of Physical Therapy annual meeting. www.qa.fsbpt.org/.../ Forum_Winter2016_WisconsinPTXrays.pdf. Accessed June 5, 2016.

163. Medicare coverage of x-rays. 2017. https://www.medicare.gov/coverage/x-rays.html. Accessed June 9, 2017.

164. Medicaid.gov. Keeping America Healthy. Federal policy guidelines. 2017. https://www.medicaid.gov/federal-policy-guidance/federal-policy-guidance.html. Accessed June 9, 2017.

165. Schaumans C. Prescribing behavior of General Practitioners: Competition matters. *Health Policy*, 2015;119(4):456 – 463.

166. Lundkvist J, Åkerlind I, Borgquist L, Mölstad S. The more time spent on listening, the less time spent on prescribing antibiotics in general practice. *Family Practice.* 2002;19(6):638–640.

167. Department of Health. Allied health professions prescribing and medicines supply mechanisms scoping project report. London: HMSO; 2009.

168. Department of Health. Consultation on Proposals to Introduce Independent Prescribing by Physiotherapists.' London: HMSO; 2011.

169. World Confederation for Physical Therapy. *Scope of practice.* 2015. http://www.wcpt.org/node/29535. Accessed June 19, 2016.

170. American Physical Therapy Association. A Normative Model of Physical Therapist Professional Education: Alexandria, VA: APTA; 2004.

171. Gargiulo G, Capodanno D, Longo G, Capranzano P, Tamburino C. Updates on NSAIDs in patients with and without coronary artery disease: Pitfalls, interactions, and cardiovascular outcomes. *Expert Review of Cardiovascular Therapy.* 2014;12(10):1185–1203.

172. IMS Institute for Healthcare Informatics Avoidable Costs in U.S. Healthcare: The $200 Billion Opportunity from Using Medicines More Responsibly. 2013. http://www.drugstorenews.com/sites/drugstorenews.com/files/Avoidable%20Costs%20in%20Healthcare.pdf. Accessed June 15, 2017.

173. Guidedoc.com. *Physical rehabilitation*. 2016. http://guidedoc.com/physical-rehabilitation. Updated 2016. Accessed June 16, 2017.

174. Healthcare Bluebook. https://healthcarebluebook.com/ pag_Default.aspx. Accessed June 16, 2017.

175. Crane M. New Study Finds 91% of Physicians Practice Defensive Medicine. *Medscape*. June 28, 2010. https://www.medscape.com/viewarticle/724254. Accessed June 17, 2017.

176. U.S. House of Representatives. Federal Tort Claims Act. https://www.house.gov/content/vendors/leases/tort.php. Accessed June 17, 2017.

178. O'Leary KJ, Choi J, Watson K, Williams MV. Medical students' and residents' clinical and educational experiences with defensive medicine. *Academic Medicine.* 2012;87(2):142-148. doi: 10.1097/ACM.0b013e31823f2c86