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Influence of a post-graduate physical therapy residency program on clinical reasoning, professional development, and career advancement in Nairobi, Kenya

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Influence of a post-graduate physical therapy residency program on clinical reasoning, professional development, and career advancement in Nairobi, Kenya

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Date Submitted

February 10, 2018

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We hereby certify that this dissertation, submitted by Shala Cunningham, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirement for the degree of Ph.D. in Physical Therapy.

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ABSTRACT

Problem Statement

Residency programs that emphasize clinical reasoning and manual therapy can provide a means to optimize the outcomes of physical therapy without the need for or access to expensive equipment. The residency format of continuing education could allow physical therapists in developing countries access to specialty training and ongoing mentorship. However, there are limited studies that investigate the influence of residency training on the progression of clinical reasoning, professional development, and career advancement.

Purpose

The purpose of this study was threefold. The first objective was to describe the outcome of a post-graduate orthopaedic manual therapy residency program on development of knowledge and clinical reasoning skills by physical therapists in Nairobi, Kenya. The second objective was to explore the influence of the residency program on the participants' professional development and career advancement. The last objective was to explore the residency experience from participants' perspectives.

Methodology

This mixed methods study utilized a sample of convenience that included residents in the third (n=14) and fourth (n=13) cohorts of the orthopaedic manual therapy residency program in Kenya. Data collection included an assessment of clinical reasoning through a live patient examination, a survey on professional and career development, and qualitative interviews.

Results

There was a significant improvement in clinical reasoning development as measured by an assessment of a live patient examination ($p < 0.001$). Based on the survey, the majority of residents responded with an extremely positive or somewhat positive response regarding the influence of the residency program on professional development and career advancement. Themes from the qualitative data included: (1) holistic, integrative clinical reasoning process, (2) knowledge and clinical reasoning skills gained and applied to clinical practice, (3) challenges recognized and reliance on support systems, (4) wider perspective and greater understanding of the profession.

Discussion

The residency program in Nairobi, Kenya may serve as a framework for the formation of post-graduate education programs in other developing countries. The development of residency programs that can influence the ability of physical therapists to provide treatment efficiently and effectively may ultimately assist in serving community physical therapy needs.

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Chapter 1: Introduction

Introduction

This chapter consists of a statement of purpose, background information regarding the residency program, a discussion of the importance and relevance of the study, the hypotheses and aims to be explored, and definitions of key terms.

Problem Statement

Access to advanced instruction, fundamental to promoting educational development, is limited throughout the country of Kenya.¹ One restricting factor has been the shortage of physical therapists with advanced degrees and specialty training to offer educational opportunities following entry-level education.^{1,2} A post-graduate residency program has previously been introduced to Kenya to assist with promotion of skill advancement, clinical reasoning development, and use of current evidence in practice.² Although theoretically accepted, limited studies have investigated the influence of post-graduate residency programs on the clinical reasoning skills of physical therapists.⁴⁻⁶

It is anticipated that novel implementation of the residency model of continuing education will promote the profession of physical therapy in a developing country, although there is no evidence to support the ability of a residency program to assist with professional development and career advancement of the residents. Furthermore, the barriers and facilitators for the success of residents in the program and for implementation of new skills into practice are unknown.

Purpose of the Study

The purpose of this study is threefold. The first objective is to describe the outcome of a post-graduate orthopaedic manual therapy residency program on development of knowledge and clinical reasoning skills of physical therapists in Nairobi, Kenya. The second objective is to explore the effect of the residency program on the participants' professional development and career advancement. The final objective is to explore from participant's perspectives' (a) barriers that affect participation in the residency program, (b) the residency program's ability to foster the use of new skills in the clinical environment, and (c) barriers to integrating concepts and skills gained during the residency program into clinical practice.

To examine the residency program's influence on knowledge and clinical reasoning development, this study utilized a pre and post-test design to compare the knowledge and clinical reasoning skills of residents in the third cohort (n=14) at initiation of the residency program and following completion of the residency program. To measure the change in knowledge and clinical reasoning skills, an objective assessment of residents' performance on a live patient examination was used. Furthermore, interviews of the graduating residents explored the clinical reasoning process utilized during the live patient examination. The use of both an objective assessment and interview allowed for the evaluation of perceptible and imperceptible elements of clinical reasoning.

Perceptible elements of clinical reasoning include the interaction of the therapist with the patient and performance of tests and measures to determine a patient's impairments.⁷ The desire to understand the patient's perspective regarding diagnosed pathology, known as the patient's explanatory model, can best be explored through patient discussions with the therapist.⁸ Imperceptible elements include the therapist's rationale for the choice of objective measurements and development of a shared meaning between therapist and patient for the pathology present and goal of the treatment.⁷

To determine the impact of the residency program on the progression of professional development and career advancement, a survey of participants that completed the residency was conducted (n=27). Residents' perspectives of their experience in the residency program were explored through individual interviews with the residents. The interviews sought to explore (1) barriers that affected participation in the residency program, (2) how participants perceived the residency program fostered the use of new skills in the clinical environment, and (3) the residents' perceptions of limitations for applying the skills gained through the residency program.

Background

Kenya is a developing nation in eastern Africa with approximately 600 registered physical therapists.¹ Physical therapists in Kenya currently have the opportunity to earn a 3-year diploma or a Bachelor of Science degree in physiotherapy.^{2-3,9} According to the World Confederation for Physical Therapy (WCPT), education for entry-level therapists should include a minimum of four

years of university level courses.¹⁰ In addition, the WCPT proposes that physical therapists should be committed to pursuing educational opportunities following entry-level education to promote the development of the profession.¹⁰

To assist with promotion of skill advancement, clinical reasoning development, and use of current evidence in practice, the Kenya Medical Training College Higher Diploma Program offered the first post-graduate orthopaedic residency program administered by the Jackson Clinics Foundation in 2012.² The Jackson Clinics Foundation (Foundation) is a non-governmental organization in the United States formed for the purpose of funding humanitarian efforts in Africa.¹¹ The residency is a partnership between the Foundation and Kenya Medical Training College (KMTC) in Nairobi.¹¹ The Foundation provides the recruitment and transportation of qualified instructors from Universities throughout the United States to Nairobi, Kenya. In addition, the Foundation delivers educational materials provided by the American Physical Therapy Association (APTA) to the residency participants. KMTC secures housing for instructors and grants a Higher Diploma in Orthopaedic Manual Therapy to successful graduates of the residency program. The mission of the Higher Diploma Program is to graduate advanced orthopaedic practitioners that can lead their communities and local profession in the advancement of clinical care and education.¹¹

Multiple steps were taken to establish the residency as a long-term educational program. During the development of the residency, meetings were held with key stakeholders including; the Foundation, the director of KMTC, and the head of the department of physiotherapy education at KMTC.¹¹ Discussions centered on a

shared vision and mission for the program with common goals for the program agreed upon. In addition, details regarding what each stakeholder could provide to ensure the success of the program were examined. Following the development of the mission for the program and drafting of a Memorandum of Understanding, the goals and scope of the program were shared with the institutions that provided entry-level physical therapy education, University of Nairobi and Kenyatta University, to ensure that misunderstandings did not ensue. In addition, the program was presented to the Kenya Ministry of Health.¹¹

The physical therapists that participate in the orthopaedic manual therapy residency program have a 3-year technical diploma in physiotherapy and have had no previous access to continuing education throughout their careers.² Coursework in the Diploma Program includes anatomy and physiology, pathology, physical modalities, therapeutic exercise, musculoskeletal practice, neurological practice, women's health, cardiorespiratory practice, community based rehabilitation and human immunodeficiency virus/ acquired immunodeficiency syndrome/ sexually transmitted infection management.¹¹ The patient management coursework within the diploma program emphasizes protocol-based treatment of conditions based on the patient's symptom presentation. Clinical reasoning is not emphasized as a critical component of the patient examination.

The utilization of protocol driven treatment application was substantiated in a 2014 study examining the clinical reasoning process utilized by physical therapists in Kenya.² Participants in the study were asked to describe their clinical reasoning during a live patient examination. The physical therapists noted patient's symptoms

as the determining factor for the treatment provided. Each symptom had an associated predetermined procedure for treatment.²

In the residency program presented in this study, participants complete six modules over 18 months. The online didactic portion of the program utilizes the Clinical Practice Guidelines and Current Concepts in Orthopedics, 3rd edition (American Physical Therapy Association) as background reading and preparation for participation in onsite modules.¹¹ Each onsite module consists of ten days of onsite education provided by physical therapy instructors from the United States. The purpose of each module is to provide the residents with the didactic education and clinical skills consistent with the orthopaedic curriculum provided by professional doctorate in physical therapy programs in the United States.¹¹ In addition to onsite modules and online resources, residents receive clinical mentoring by instructors from the United States. The mentorship is focused on integrating the knowledge and skills learned during the residency program into clinical practice.¹¹

Instructor qualifications include being a faculty member currently teaching in the area of orthopaedics within an accredited United States physical therapy program or having an advanced certification in both orthopaedics and manual therapy.¹¹ For residents to progress in the program, all requirements must be passed at a minimum of 75%. Residents must achieve adequate performance on both a written and a practical examination provided at the completion of each module. Following completion of the 18-month residency program, residents must

successfully pass a comprehensive written examination and a live patient practical examination to fulfill the requirements of the Higher Diploma.¹¹

The design of the residency program attempted to address the cultural differences in student learning preferences between the United States and Kenya. The United States is considered a low-context culture.¹² In low-context cultures, educational materials are the primary resource for learning.¹² Students are able to acquire a significant amount of knowledge through textbooks and online resources. In contrast, in a high-context educational system, face-to-face encounters with the instructor are the primary resource for learning.¹² The utilization of onsite modules and mentorship throughout the residency program allowed for instructors to have interactions with the residents on a monthly basis. In addition, the use of a program administrator within the country provided a direct contact for the residents.

Importance and Relevance of the Study

In the year 2000, it was estimated there were 234 million people with moderate or severe disabilities living in developing countries.¹³ This number is projected to grow to 525 million in 2035.¹³ Although there are limited numbers of physical therapists available to provide services in these countries, there is an opportunity to maximize the potential of physical therapy that is available for the benefit of those in need.

Residency programs have been established in the United States to provide both the declarative and procedural knowledge needed for the development of expertise.¹⁴ Although accepted from a theoretical perspective, limited studies have investigated the influence of post-graduate residency programs on the clinical

reasoning skills of physical therapists.⁴⁻⁶ Residency programs that emphasize clinical reasoning and manual therapy skills could provide a means to optimize the outcomes of physical therapy (minimize pain, normalize movement and maximize function) without the need for or access to expensive equipment.² If successful, the orthopaedic manual therapy residency program in Kenya could provide access to effective treatment techniques without material resources, as well as a framework for the formation of additional residency programs in developing countries with limited educational and fiscal resources. Furthermore, specialty training could increase the availability of local physical therapists to provide continuing education opportunities.

Research Hypotheses and Aims

Quasi-experimental design

Research Question: Does participation in an 18-month post-graduate orthopaedic manual therapy residency program, following successful completion of a technical diploma, improve participating physical therapists' knowledge and use of clinical reasoning in the examination and evaluation of outpatient orthopedic populations as assessed through a live patient practical examination?

Hypothesis: There will be a significant increase in scores on the Practice Dimensions Examination when comparing baseline and final live patient practical examination scores of physical therapists in the third cohort of the residency program.

Non-experimental survey design

Research Question: How does participation in and completion of an 18 month- orthopaedic manual therapy residency program influence the professional development and career advancement of residency graduates practicing in Kenya as surveyed upon completion of the residency program?

Hypothesis: Graduates of the residency program will report a positive influence of the program on their ability to perform a systematic clinical examination, apply a logical clinical reasoning process when performing patient examinations, perform differential diagnosis of a complex patient, implement effective and efficient treatment interventions, and improved access to new job opportunities.

Qualitative design

Research Questions:

RQ 1. What was the clinical reasoning process described by participants during the live patient examination?

RQ 2. What new skills were fostered by the residency program for use in the clinical environment as perceived by the participants?

RQ 3. What barriers to participation did participants perceive they encountered as they progressed through the residency program?

RQ 4. What barriers did participants encounter when attempting to integrate concepts and skills gained during the residency program into their clinical practice?

Definitions of Key Terms

Career advancement: The perceived increase in work-related characteristics including salary, job promotion, job opportunities, leadership roles, ability to critically evaluate scientific literature, and ability to obtain research opportunities.^{4,5}

Clinical reasoning assessment: The assessment of clinical reasoning through objective, measurable components including the collection of key information, the determination of reassessment measures, and treatment implementation.^{2,7} For the purposes of this study, narrative reflections are utilized to assess the cognitive processes utilized when determining provision of care.

Explanatory Model: The explanatory model emphasizes the need to understand the patient's perspective regarding diagnosed pathology.⁸ The patient and practitioner must agree on the goal of the treatment for the intervention to be successful from both perspectives. To meet the patient's needs, the practitioner must explore the patient's explanatory model (EM), his/her beliefs of what is wrong and how it has affected his/her life.⁸

High-context culture: Within a high-context culture, nonverbal communication is based on an awareness of cultural norms. Face-to-face encounters with the instructor are the primary means of instruction and written materials are often not utilized by the student.¹²

Low-context culture: In a low context culture, communication occurs explicitly.¹² Written instructions and educational materials contain significant detail and are used as the primary resource for student instruction.

Post-graduate orthopaedic manual therapy residency program: A structured experience, including evidence based course work and mentoring, that is designed to advance the therapists' knowledge, skills, and clinical reasoning in the area of orthopaedics with a focus on manual therapy techniques.¹⁴

Professional development: The advancing of one's ability to treat effectively and efficiently to achieve projected patient outcomes, communicate with patients and other health professionals, and perform overall patient management.^{4,5}

Summary

Access to advanced instruction, which is fundamental to promoting educational development, is limited throughout the country of Kenya. A residency program was developed to provide an opportunity for advanced education with a focus on clinical reasoning and manual therapy. However, there have been limited studies to investigate the influence of residency training on the progression of clinical reasoning, professional development, and career advancement.⁴⁻⁶

The purpose of this study was to describe the outcomes of post-graduate orthopaedic manual therapy residency training on the clinical reasoning development, professional development, and career advancement of physical therapists participating in an 18-month residency program in Nairobi, Kenya. This study also sought, via individual interviews, to identify barriers that affect participation in the residency program and utilization of clinical skills acquired

through the residency program. The expansion of residency programs in developing countries that can influence the ability of physical therapists to provide treatment efficiently and effectively may ultimately assist in serving community physical therapy needs.

Chapter 2: Review of the Literature

Introduction

This chapter is devoted to a review of the literature. The review is organized into the following sections: the history of residency programs, the educational model for residency programs, outcomes related to residency training, clinical reasoning theories, cultural differences in teaching clinical reasoning, clinical reasoning outcome measurements, and a summary of the insights gained from this review of the literature. In addition, this chapter will provide the statement of the problem and the contribution this study will make.

History of Residency Programs

Residency programs for physical therapists have been available in the United States since 1979.¹⁴ A clinical residency program is a structured experience for physical therapists following professional education designed to advance the therapist's knowledge, skills, and clinical reasoning in a specific area of practice.¹⁴ The residency experience combines opportunities for ongoing mentoring with course work designed to provide a theoretical basis for advanced practice.¹⁴ In 1996, the American Physical Therapy Association (APTA) Board of Directors approved the credentialing of residency programs, therefore recognizing residencies as post-graduate educational programs designed to significantly advance the physical therapist's skills in clinical practice.¹⁴

There has been a movement in the United States towards autonomous practice within the profession of physical therapy, endorsed through the Vision Statement 2020 presented by the APTA House of Delegates (APTA-HOD) in 2000.¹⁵

The Vision states that by 2020, physical therapy services will be provided by doctors of physical therapy. In addition to changes in the curriculum for entry-level physical therapy education with the introduction of a doctoral-level professional degree, there has also been a significant increase in the number of clinical residency programs. Clinical residency programs are designed to develop novice physical therapists with the clinical reasoning skills which are necessary to address complex patient scenarios that may be encountered through direct access.¹⁴ In November of 2000, the APTA Board of Directors expanded credentialing services to include fellowship programs and created the Committee on Clinical Residency and Fellowship Program Credentialing.¹⁴ In 2009, the Committee on Clinical Residency and Fellowship Program Credentialing was restructured into the American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE). In 2010, ABPTRFE was granted authority to develop the requirements for a residency program to be credentialed. The terminology for recognizing post-graduate residency and fellowship education was changed from credentialing to accreditation in 2014.

In 2015, the APTA Board of Directors formed the Best Practice for Physical Therapist Clinical Education Task Force (BPCETF) to identify best practice for the clinical education of physical therapists. The BPCETF provided five content recommendations and one dissemination recommendation in 2017 to the APTA Board of Directors.¹⁶

The first recommendation supports mandatory post-professional residency education.¹⁶ The recommendation includes the continued professional training of

physical therapists with a foundational level of competence to manage patients. Currently students take the federal licensure examination following graduation from an accredited physical therapy program. In the proposed model of professional education, graduation from an accredited PT program would result in restricted licensure. The expectation is that the new graduate would continue their education with specialization in a practice area. This would begin with a structured, post-graduate clinical internship followed by residency education. Residency education would be followed by a specialist certification examination and entry into unrestricted licensure.¹⁶

The underlying assumption of this proposed model is that residency education results in advanced knowledge and clinical reasoning skills.¹⁶ However, limited studies have investigated the influence of residency programs on the skill and clinical reasoning development of physical therapists.⁴⁻⁶ Despite the absence of scientific evidence to support residency training, in 2017, there were 206 accredited physical therapy residencies and 32 accredited fellowship programs offered in the United States.¹⁴

Educational Model for Residency Programs

The American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) is the current accrediting agency utilized to assure the quality of post-graduate residency education programs in the United States.¹⁷ The Board ensures the curriculum of the residency program reflects the current *American Board of Physical Therapy Specialties Description of Specialty Practice*.¹⁷ ABPTRFE sets the requirements for the didactic and clinical experiences provided within accredited

programs for orthopaedic therapy. In addition, ABPTRFE outlines the minimum hours devoted didactic and clinical education.¹⁷ All residents must perform 75 hours of didactic instruction and 150 hours of one-to-one mentoring. Similar to orthopaedic residencies in the United States, the residency program in Kenya follows the curricular guidelines outlined by ABPTRFE to advance the knowledge, manual therapy skills, and clinical reasoning development of participants with one exception: clinical mentoring is limited by geographical location and Internet accessibility for the residency program in the Kenya. Mentors travel to Nairobi from the United States to provide mentoring with the residents in their current clinical setting, however, the mentoring does not presently meet the ABPTRFE minimum of 150 hours of direct one-to-one mentoring.¹⁷ There is currently no credentialing or accreditation agency for post-professional physical therapist education in Kenya.

Outcomes Associated with Residency Training

Current literature suggests graduates of physical therapy residency programs value the post-graduate education for its influence on clinical reasoning development, professional development, and career advancement.^{4,5,18} To investigate residency graduates' perceptions of the influence of a residency program, Smith, et al. developed a 44 question survey.⁴ The questionnaire was reviewed by an expert panel for content validity and was pilot tested in Australia. The research group then surveyed residency graduates from a manual therapy residency program in California in 1996.

At the time of the survey study, there were 13 orthopaedic residency programs in the United States, and the oldest and largest residency program in the United States was chosen to recruit participants for the survey. The residency program was developed based on manual therapy programs in Australia. The survey was mailed to all 98 graduates of the program.⁴ There was a 92% response rate with 90 respondents. Graduates reported the program had a positive influence on their ability to perform a comprehensive evaluation, utilize clinical reasoning in treatment decisions, and implement an effective treatment plan by employing scientific literature.⁴ In addition, graduates reported career advancement through promotions and increases in salary.⁴ Limitations of the study included the use of a single residency program limiting generalizability to other residency programs. A study conducted by Jones et al. in 2008 expanded on the initial Smith et al. survey by adding a comparison group of non-residency trained physical therapists with similar years of experience in orthopaedic physical therapy.⁵ In addition to the original 1996 survey content, additional questions explored participation in other formats of post-graduate education, attainment of board certification, professional committee participation, teaching experiences, and publication in peer reviewed journals.⁵ The study utilized a web-based survey distributed to residency graduates (n=78) and non- residency trained physical therapists (n=163). The overall response rate for the survey was low at 25% with responses from 41 residency graduates and 20 non-residency trained physical therapists. The response rate from the comparison group was 12%, which limited the external validity of the study.⁵

Results show residency graduates were more likely to become board-certified physical therapy specialists and to provide continuing education coursework compared to non-residency graduates.⁵ Likewise, residency graduates earned a higher income when compared to non-residency trained physical therapists with similar experience.⁵ Residency graduates made an average of 9% more than non-residency trained physical therapists.

A survey study has also been used by Cunningham and McFelea to explore the influence of an orthopaedic residency program in Kenya.¹⁸ In 2010, the first post-graduate physical therapy orthopaedic manual therapy residency program was offered in Kenya. To explore the influence of the residency program on professional development and career advancement, a survey was provided to the first residency program cohort upon completion of the program in 2012.¹⁸ The survey utilized was adapted by residency instructors from previously published outcomes of residency training in the United States.^{4,5} The adapted survey included demographic information and 20 items related to the residents' professional development and career advancement. The survey utilized a five-point Likert scale ranging from major positive to major negative.¹⁸

All 15 residents in the first residency cohort agreed to participate in the study. The residents completed the survey following their final live patient practical examination. Internal consistency for the two sections was determined through Cronbach's alpha. Cronbach's alpha for professional development was 0.864 and career advancement was 0.712.¹⁸ Similar to the results of survey studies performed with residency graduates in the United States, all of the graduates reported a

positive or major positive influence of the residency training on their ability to: (1) perform a thorough clinical examination; (2) use a logical clinical reasoning process; (3) determine the nature of a patient problem; (4) treat complex patients; (5) treat effectively to achieve projected outcomes; (6) perform overall patient management; (7) use scientific literature to provide rationale for interventions; (8) critically read and evaluate scientific literature; (9) communicate with patients; and (10) communicate with other health professionals.¹⁸ In addition, all graduates reported an increase in the number of patient referrals and the number of professionals referring patients to them following the residency program.¹⁸ Sixty-percent of the graduates reported job promotion based on completion of the residency program.²⁰ Dissimilar to the survey studies performed in the United States, only 46.7% of Kenyan residency graduates reported a change in salary.

Despite the positive subjective reports of improvement in clinical reasoning and career advancement noted by survey based studies, residency education in the United States has not been shown to necessarily improve patient outcomes.⁶ Utilizing the Focus On Therapeutic Outcomes (FOTO) database, Rodeghero et al. retrospectively compared patient outcomes between physical therapists without residency or fellowship education to physical therapists that had completed an orthopaedic residency program accredited by the ABPTRFE. The FOTO database utilizes the functional status outcome measure. The outcome measure is based on the body region receiving treatment. A total of 363 physical therapists participated in the study with outcomes from 25,843 patients assessed.⁶

Physical therapists were classified into one of three groups based on their post-professional education: no residency or fellowship training, residency training, and fellowship training. Although the groups were not compared by years of experience, 83% of the therapists with fellowship training had been practicing 10 or more years compared to 59% of the therapists without residency or fellowship training and 33% of residency trained therapists. Furthermore, 43% of the residency-trained therapists had practiced less than 5 years compared to 26% of non-residency trained therapists. There was no difference in functional outcomes between the therapists with residency training and therapists without residency training. Furthermore, the non-residency trained therapists achieved these outcomes in fewer treatment visits.⁶ Physical therapists with fellowship training did demonstrate improved functional outcomes compared to the other two groups. Limitations included selection bias due to the relatively small numbers of physical therapists responding to the survey and participating in the FOTO database, with only 7% of the therapists registered with FOTO agreeing to participate in the study.⁶ The groups were not assessed by years of experience, which may have attributed to the treatment efficiency. In addition, the investigators choose to omit patients with data missing from the analysis, which further increased the possibility of selection bias.

According to the APTA, residency programs established to provide both declarative and procedural knowledge integral to development of expertise, may provide a practical model for educational experiences that improve knowledge,

skills, and clinical reasoning of participants.¹⁴ Although residency graduates subjectively value the advanced education for its influence on skill development and clinical reasoning advancement, additional information is needed regarding the influence on patient outcomes.⁴⁻⁶

Clinical Reasoning Theories

Three key theories have been proposed to explain the clinical reasoning process utilized by physical therapists: the hypothetical-deductive reasoning model, pattern recognition model, and narrative reasoning model.¹⁹ Current literature indicates a difference in clinical reasoning processes utilized by novice clinicians compared to expert clinicians.¹⁹ Novice clinicians tend to use hypothetical-deductive reasoning and expert clinicians have been shown to rely on pattern recognition and narrative reasoning during the clinical decision-making process.¹⁹⁻²¹ Each of these three key theories will be described.

Hypothetical-deductive Reasoning Model

The hypothetical-deductive process, developed by Elstein in 1978, describes four main steps involved in clinical reasoning.²² The four steps are cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation. Each hypothesis generated is used to guide the subsequent collection of data.²⁴ Continued hypothesis generation and revision occurs throughout the evaluation and treatment of the patient as the practitioner receives and interprets additional cues.²²

Based on hypothetical-deductive theory, initial studies on clinical reasoning in medicine focused on observable behaviors associated with general skills that could be assessed through psychometric testing.²³ Initial studies on clinical reasoning by Rimoldi, as accounted by Higgs, counted the number of questions required by medical students and experienced physicians to determine a hypothetical diagnosis given a patient case.²³ This study found physician's questions were more focused and fewer in number compared to medical students, suggesting that practical experience improves the reasoning process.²³

Elstein expanded on the research performed by Rimoldi using standardized patients to examine the clinical reasoning of experienced internal medicine physicians.²² The standardized patients were trained to provide a consistent history and symptoms. Lab results were provided to the physicians following the examination if requested. Patient examinations were videotaped to observe physicians explaining their reasoning process with each question and action performed. Twenty-four internists examined three simulated patients, determined a diagnosis, and prescribed a treatment plan.²² The physicians developed a series of hypotheses within the first few minutes with the patient and were able to assess up to five hypotheses at one time, never exceeding five.²² Common errors in interpreting information within this model included simplifying the patient presentation by interpreting findings to be consistent with a single hypothesis and ignoring findings inconsistent with the chosen primary hypothesis.²²

Elstien's research was repeated in 1985 by Payton to look at the clinical reasoning strategies used by physical therapists.²⁴ Payton selected ten expert

physical therapists involved in four different areas of practice. The subjects were a sample of convenience and identified as expert clinicians by a single faculty member. Five therapists were considered experts in orthopaedics, three in neurological physical therapy, one in hand therapy, and one in cardiopulmonary physical therapy. The subjects had an average of 9.5 years of clinical experience.²⁴

Rather than utilizing standardized patients, the subjects examined new patients within their clinical environment. Payton audiotaped initial evaluations performed by each of the ten experts. The therapist and investigator then listened to the tapes as the therapist described their reasoning process.²⁴ Similar to Elstien's research involving physicians, nine of the ten therapists determined preliminary hypotheses in the first few minutes of the evaluation. One therapist determined a problem list prior to seeing the patient based on an available chart review. Cue acquisition, hypothesis formation, and treatment planning were intertwined and repeated throughout the encounter.²⁴ Payton concluded that physical therapy students should be taught to determine multiple hypotheses early in the patient encounter, and to use a hypothetical-deductive clinical reasoning process to narrow the possibilities to the most probable diagnosis.²⁴

The utilization of hypothetical-deductive reasoning in physical therapy was further supported by a study by Rivett and Higgs in 1997, who explored the process of hypothesis generation by physical therapists.²⁵ The study included nineteen physical therapists in Australia that had varying amounts of experience in manual therapy. The subjects were placed into one of two groups, expert and less expert.²⁵

The expert group was comprised of eleven therapists with post-graduate

qualification in manipulative therapy, current practice in an outpatient setting, and a minimum of five years clinical experience.²⁵ The less expert group included eight therapists initiating a post-graduate course in manipulative therapy.

Subjects watched two videotaped subjective examinations of patients with low back pain.²⁵ The first videotape was to familiarize the subjects with the process of watching the video and providing comments on the examination being performed. Data from the second interview was used for analysis. The therapists communicated their thoughts on the clinical relevance of the information provided during predetermined pauses in the videotape using the think out loud process, where the subjects were asked to say whatever came into their mind as they watched the examination.²⁵ The subjects were also encouraged to document information they found clinically relevant in written format.

Information was coded within a predetermined theory for clinical reasoning using the hypothetical-deductive reasoning model.²⁵ The seven pre-determined coding categories included: source of the symptoms, contributing factors, precautions and contraindications to physical examination and treatment, management, mechanisms of signs and symptoms, reassessment, and prognosis.²⁵ To analyze the data, the investigators counted the number of therapists that verbalized evidence of initial hypothesis generation in the first minute of the interview. Seventy-five percent of all therapists, expert and less expert, generated hypotheses within the first minute of the patient's history.²⁵ The investigators then considered evidence of each of the seven pre-determined coding categories. All therapists considered hypotheses in multiple categories and planned reassessment

procedures. The therapists also consistently considered contributing factors to the pathology and contraindications to treatment. There was no significant difference between the groups.²⁵ The conclusion of the study was that all therapists, regardless of expertise, use some form of hypothetical-deductive reasoning.²⁵ The researchers concluded that physical therapy educators could confidently instruct student physical therapists in a form of hypothetical-deductive reasoning to examine patients.

May et al. performed a qualitative study to gain an understanding of the clinical reasoning used by therapists with limited experience managing musculoskeletal problems.²⁶ The mean age of the nine participants was 28 years with 3 years of experience as a qualified physical therapist in the United Kingdom. Participants were provided a verbal case describing an orthopaedic patient evaluation. Following the case presentation, semi-structured interviews were performed. An interview guide was used, however new ideas exposed within the interview were also explored.²⁶ Data analysis was done through framework analysis, which stipulates that for a theme to be included in the final data analysis, it must have been mentioned by 50% of the participants.²⁶

Seven themes emerged in the study: history taking, physical examination, investigations, diagnostic reasoning, diagnostic pathway, management pathway, and treatment.²⁶ The dominant clinical reasoning strategy utilized by the therapists was the hypothetical-deductive process. Sub- themes related to the hypothetical-deductive process included cue acquisition, hypothesis generation, cue evaluation, and hypothesis evaluation.²⁶ However, many cues considered key in the diagnosis of

shoulder pain were not included as a final item by 50% of the participants, suggesting that cue acquisition was incomplete and there were minimal connections made between history and physical exam findings. The conclusion reached was that the therapist with limited experience in orthopaedics did not have a well-developed clinical reasoning process for the assessment of patients within the speciality.²⁶

Masley et al. performed a qualitative study using a grounded-theory approach to explore the decision making processes used by acute care physical therapists.²⁷ A purposive sample of 20 physical therapists from three medical centers was utilized in this study. Semi-structured interviews were audio recorded and transcribed. The therapists were asked about their treatment of patients and the discharge planning process.²⁷ Concepts and themes were determined through the constant comparative method. Member checks were performed to ensure the researcher's interpretations were accurate.

Four themes emerged to described the clinical reasoning processes used by the therapists: collection and analysis of medical information, application of knowledge, communication with the patient and other caregivers to gain information, and communication to provide information.²⁷ In addition to these themes, the researchers found the professional role and environment influenced the clinical reasoning process.²⁷ The acute care physical therapist felt a professional responsibility to the patient and their coworkers and believed this was a key factor in obtaining patient outcomes. They also discussed the complexity of the environment due to the acuity of the patient.

Participants described initial cue acquisition occurring during the medical record review prior to assessing the patient. Information gained through the medical record review included vital signs, lab values, and activity restrictions.²⁷ During the assessment of the patient, additional cues related to the patients' mobility were gathered. The therapists discussed the need to be able to make adaptations to the treatment plan based on the patient's medical stability. In addition, the therapists discussed the need to communicate with other health professionals and caregivers to ensure quality patient-centered care.²⁷

Clinical reasoning described by the therapists encompassed both hypothetical-deductive reasoning and narrative reasoning. Hypothetical-deductive reasoning was utilized during the patient assessment and treatment. Narrative reasoning was utilized when making decisions as an interprofessional team.²⁷ The clinical reasoning process occurred over the entire episode of care, including the development of long-term goals and discharge planning.²⁷

Edwards et al. performed a qualitative study to determine the clinical reasoning strategies used by six expert physical therapists within three areas of physical therapy: neurological physical therapy, orthopaedic manual therapy, and home health care.¹⁹ A grounded theory, case study approach was utilized with two expert clinicians from each specialty serving as primary informants. The cases for the study were comprised of the six expert therapists and the therapist's respective practices. The data was collected over a one year time period and consisted of observation of treatment sessions, unstructured interviews, and semi-structured interviews.¹⁹

A total of seventy-nine treatment sessions were observed.¹⁹ The six physical therapists were observed over several days in the clinic. The primary researcher recorded field notes that included nonverbal interactions between the therapist and patient. The treatment sessions and interviews were audiotaped and transcribed. In addition, each participant was asked to submit a written account of significant influences in their professional careers.¹⁹

From the seventy-nine treatment sessions, six case studies were developed. The case studies were provided to six expert therapists teaching at the University of South Australia. Subsequent semi-structured interviews were performed with six additional expert physical therapists.¹⁹ The expert physical therapists were asked the same questions as the therapists that were shadowed in the clinic. This additional data was utilized to support the information gained from the first group.

Three coders analyzed the transcripts from each of the three sessions of data collection: (1) field notes and transcripts from the treatment sessions, (2) written material from the six physical therapists that participated in the treatment sessions, and (3) semi-structured interviews from the six expert physical therapists that reviewed the case studies.¹⁹ The initial transcripts and written materials were coded for sources of knowledge, knowledge frameworks, and clinical reasoning strategies.¹⁹ The themes were then cross checked with the interviews from the third session of data collection. Member checks were also performed with the participants to ensure the credibility of the themes developed.

The researchers determined that clinical reasoning strategies were often used synchronously. The hypothetical-deductive process was used to diagnose the

patient and the narrative process was utilized to understand the patient's beliefs regarding the disability.¹⁹ The therapists responded to cues provided by the patient to determine the sequence of the evaluation versus following a specific protocol. Furthermore, the therapists used open-ended questions to understand the patient's beliefs about the pathology. As cues were assessed, therapists often included the patients beliefs into the determination of hypothetical diagnosis and contributing factors.¹⁹

Similar to hypothetical- deductive reasoning, the Hypothesis-Oriented Algorithm for Clinicians (HOAC), presented by Echternach and Rothstein, emphasizes the initial hypothesis generation by physical therapists through the interpretation of cues.²⁰ This model is similar to the hypothetical-deductive process, although, the HOAC describes eight rather than four distinct components within the clinical reasoning process. These eight major subdivisions of the HOAC include; (1) initial data collection (subjective interview and patient history), (2) development of a problem statement, (3) establishment of goals, (4) physical examination, (5) hypothesis generation, (6) development of reevaluation methodology, (7) treatment planning, and (8) treatment implementation.²⁰ The hypothesis is confirmed or refuted by the association of the patient's history and objective testing. Clinical reasoning in this model is a fluid process with both outcome assessments and continual reassessment. Treatment strategies should be directly linked to the patient's impairments associated with the diagnosis. The model provides a framework for clinical decision-making and provides instructors a system to assess a student's ability to move forward in the clinical reasoning process.²⁰

In 2003, Rothstein, Echternach, and Riddle published the HOAC II in response to the movement of the physical therapy profession towards autonomous practice and the increased role of the physical therapist in injury prevention.²⁸ The revised model acknowledged two distinct classifications of patient complaints: (1) patient-identified problems (PIPs), which include functional limitations and disabilities present at the examination and (2) non-patient-identified problems (NPIPs), which consist of anticipated problems in the future that can be addressed through prevention.²⁸

The algorithm is organized into part one and part two. Part one of the algorithm focuses on examination, evaluation, diagnosis, prognosis, and intervention.²⁸ It includes collecting initial data through a medical record review, observation, and gathering of a subjective history. From this information, the PIP list is generated. The PIP list leads to the generation of initial hypotheses to be assessed during the patient examination.²⁸ Following the patient examination and refining of the hypotheses based on the findings, the NPIPs are added to the problem list.²⁸ For each PIP, hypotheses are created for the cause of the limitation. For each NPIP, a rationale for anticipating the problem is necessary, including the presence of risk factors. Measureable and functional goals should be developed for each problem identified, with a treatment plan and intervention strategy developed and implemented.²⁸

Part two of the algorithm focuses on monitoring a patient's progress throughout the intervention and making adaptations to the care plan as needed.²⁸

This includes reassessment and refining of the hypothetical diagnoses generated in part one. Since published, several case studies using the HOAC II have been presented.^{29,30}

Two orthopaedic case studies have been published to demonstrate the effective use of the HOAC II in the examination of patients.^{29,30} The cases described the examination of a patient with low back pain and the examination of an elite athlete. In both cases, a PIP list was developed following the subjective examination. Based on the list, the physical therapist developed a strategy for examining the patient. The original hypotheses were refined based on the examination findings and risk factors for development of chronic pain were incorporated. Functional goals were developed based on the patients problem list. Once the treatment was initiated, constant reassessments of the patients limitations were performed to ensure the patient was progressing through the treatment plan as expected and to determine if adaptations to the treatment plan needed to be made. In both cases, the therapist believed the use of the algorithm assisted with the development of an effective treatment plan.^{29,30}

Pattern Recognition Model

In addition to the hypothetical-deductive process, expert practitioners have demonstrated the use of pattern recognition or illness scripts to aid in the diagnosis of patients. Pattern recognition uses experience from previous patient encounters to determine a diagnosis.^{19,21} In this model, the clinician assigns a case or patient presentation to a category based on experience with patients. Pattern recognition allows the therapist to limit the number of tests and measures performed prior to

confirming or refuting the hypothetical diagnosis. That is, the therapist can clearly identify the additional findings necessary to complete a clinical picture and relate these findings to the patient presentation.²⁶ Pattern recognition requires significant clinical experience to develop an organized knowledge base. From this perspective, inexperienced clinicians would not have had adequate exposure to multiple patient diagnoses and presentations to effectively utilize pattern recognition.²¹

Reasoning errors noted in the pattern recognition model focus on availability and representiveness.²² Availability relates to the tendency of clinicians to more easily recall vivid events and underestimate the frequency of occurrence of commonplace events.²² The second error is representativeness. This refers to the error of not considering all hypotheses equally probable. According to Elstein and Schwartz this can lead to the error of “incorrectly concluding that the probability of a joint event (such as the combination of findings to form a typical clinical picture) is greater than the probability of any of these events alone.”²² The result is placing too much emphasis on small probabilities and not enough emphasis on large probabilities.

The use of pattern recognition by expert practitioners has been explored with ten physical therapists in the United Kingdom by King and Bitchell.³¹ Five of the physical therapists in the study had undergone specialist post-graduate training similar to residency training in the United States. The other five subjects were matched based on years of experience in musculoskeletal treatment and had no formal post-graduate training.³¹ The subjects were provided a case history describing a patient with lateral stenosis of the lumbar spine.³¹ The case history was

divided into five sections; subjective history parts 1, 2 and 3, and objective examination parts 1 and 2. Following provision of each the five sections, the subjects were asked to provide a diagnosis for the patient. All subjects with specialist training gave the correct diagnosis of lateral stenosis.³¹ Only one of the five generalist subjects provided the correct final diagnosis.

The subjects participated in an interview after each of the five sections where they were asked about their current understanding of the case based on the information provided and all hypothetical diagnoses.³¹ The interviews were audiotaped and transcribed. It appeared the specialists immediately organized information into clinical patterns to identify syndromes.³¹ The non-specialist group did not use a form of pattern recognition, but considered information in isolation. This group appeared to closely follow the hypothetical- deductive reasoning process. In contrast, the experts spent more time considering information provided in each of the five sections.³¹ The experts considered multiple hypotheses initially, but they determined the correct final diagnosis more quickly.³¹

A qualitative study by Noll, Key, and Jensen explored an expert therapist's clinical reasoning process.³² The investigators were interested in the influence of experience during an evaluation, what aspect guides an expert's evaluation, and confidence with a working hypothesis.³² A single, experienced physical therapist in the McKenzie method was videotaped performing an evaluation and follow up visits with 6 patients with low back pain.³² Retrospective interviews with the therapist were audiotaped and transcribed. Initial codes were predetermined from key elements in clinical reasoning literature: (1) working hypothesis formation, (2)

clinical experience, and (3) prognostication. Three additional codes emerged from the transcription: elimination, pattern recognition, and McKenzie method.³² Analysis of the data provided a conceptual model of the therapist's clinical reasoning. The researchers concluded the therapist utilized two processes to develop a working hypothesis: backward reasoning or hypothetical-deductive reasoning and forward reasoning or pattern recognition.³² The therapist used both processes in all six patients. The clinician's confidence with the working diagnosis determined the extent to which each clinical reasoning process was utilized.³² The researchers concluded that experience affects clinical reasoning strategies utilized in patient care.

Current literature suggests clinical reasoning strategies evolve as clinicians gain experience.^{21,33} The expert therapist uses a form of pattern recognition based on knowledge gained through years of clinical experience. Multiple studies have been performed to compare the clinical reasoning process of expert practitioners compared to novice physical therapists.^{21,33}

Doody and McAteer performed a qualitative study to investigate the clinical reasoning of expert and novice physical therapists practicing in an outpatient setting.³³ All experts in this study had participated in formal post-graduate training in manual therapy. Novices were students enrolled in a bachelor degree of physiotherapy program in Dublin, Ireland.³³ The twenty participants were

audiotaped performing an assessment of a patient. The audiotaping was then reviewed by the participant and researcher immediately following the patient encounter and the participant was asked about the clinical reasoning process utilized with the patient.³³

The study used triangulation of data sources including observation, audiotaping, use of field notes, and a semi-structured interview.³³ Participants were asked to think aloud during review of the recorded patient interaction. Coding was performed using a transcript that combined audiotaped sessions and field notes.³³ The study found that experts spent more time on the subjective interview and less time with objective testing compared to the novice therapists.³³ In addition both groups used hypothetical- deductive reasoning in a cyclical manner throughout the assessment. The experts utilized pattern recognition at times during the assessment resulting in less time being spent on the objective testing of the patient.³³

Jensen et al. compared clinical reasoning of three master clinicians with that of three novice clinicians through a qualitative case study approach.²¹ A purposive sampling technique was utilized to determine the sample. Three patient care treatment sessions were audiotaped for each therapist and individual interviews were performed with the patient and the therapist.²¹ The interviews with the patient explored the shared meaning of the course of treatment and outcomes between the therapist and patient.²¹ Interviews with the therapist focused on the decision making process. Each of the three investigators performed data collection for one expert and one novice clinician.

Transcriptions from the observations and interviews were coded using a previously determined coding scheme from studies involving expert and novice clinicians.²¹ The five predetermined themes included; allocation of treatment time, impact of the environment on the treatment session, information gained from the patient, therapeutic intervention, and incorporation of social and therapeutic interactions.²¹ The themes were then revised by the research team following review of the case reports generated from the original data. Each of the researchers wrote a case description for each therapist observed. A cross-case study analysis was then performed to contrast the novice and expert clinicians.²¹ The expert clinician was found to have better control of the treatment session in maintaining a patient centered focus and efficient use of time. In addition, the expert clinician used a framework to gather objective data resulting in a clear picture of the patient's complaint and limitations. In contrast, the novice clinician retrospectively created the framework and could not easily deviate from a flow of procedures.²¹ Expert clinicians were also able to utilize both verbal and non-verbal communication with the patients to relay attention and build rapport. Novice clinicians used closed ended questions that focused more on factual information.²¹ Novice clinicians focused on treatment techniques in contrast to expert clinicians. Expert clinicians valued patient education equally with hands on treatment. Lastly, expert clinicians reported they were more confident with predicting prognosis and patient outcomes than were the novice clinicians.²¹

Narrative Reasoning Model

The third model is the narrative reasoning process, in which the physical therapist utilizes the information gained through the interaction with the patient to integrate the patient's experience and values into the reasoning process.¹⁹ In this model, the therapist strives to gain insight into the patient's perspective regarding their disability and health behaviors. The patient's perspective can then be integrated into the intervention provided. In contrast with hypothetical-deductive reasoning, the patients' perspectives are not confirmed through objective testing. The shared understanding of the patient's interpretation of their unique experience is determined by consensus between the therapist and patient.¹⁹

Kleinman emphasized the need to understand the patient's perspective regarding the patient's pathology.⁸ He described *illness* as the patient's complaints and perspective of the problem. He discussed *disease* as the healthcare practitioners' narrow perspective of the biomedical disorder. Kleinman noted that practitioners rarely analyze the meaning of illness from the patient's perspective, resulting in limited effectiveness of care and frustration for all involved.⁸ According to Kleinman, the patient and practitioner must agree on the goal of the treatment for the intervention to be successful from both perspectives. In order to meet the patient's needs, the practitioner must explore the patient's explanatory model(EM). The patient's EM is the means by which the patient understands the nature or their illness or pathology. To elicit the patients EM, the practitioner must explore the patient's beliefs of what is wrong and how it has affected the patient's life.⁸

Cultural Differences in Teaching Clinical Reasoning

The cultural elements related to teaching and learning clinical reasoning have been extensively researched by Hofstede.³⁴ In his cultural dimensions theory, Hofstede outlined four cultural dimensions to be considered when teaching clinical reasoning. The dimensions include power distance, uncertainty avoidance, collectivism versus individualism, and masculinity versus femininity.³⁴

Power distance describes how power relationships are viewed within a culture.³⁴ The United States has a low power distance culture, which has resulted in a trend towards student-centered learning.³⁴ Relationships between students and teachers are expected to be participatory and consultative. Students are less concerned with status and are willing to challenge instruction provided.³⁴ In contrast, Kenya has a high power distance culture. In high power distance cultures, it is believed that each person has a relative position in the hierarchy of authority.³⁴ Learning is a teacher-centered process in which the teacher is seen as the expert.³⁵ Participation of the student in the dissemination of knowledge is limited.

Uncertainty avoidance is the society's tolerance of ambiguity in life.^{34,35} Kenya has a high uncertainty avoidance culture. People take comfort in what is known and may be hesitant to incorporate new ideas or take risks. Teachers are seen as experts and do not typically admit to not knowing information.³⁶ Students require clear instructions and affirmation of their views. They may be hesitant to speak up in classrooms or express an opinion due to the risk of failure. The uncertainty of a diagnosis and weighing of multiple hypotheses in the clinical setting would be difficult for a student from a high uncertainty avoidance culture.³⁵ The

consideration of multiple possibilities for the patient diagnosis without an ultimate correct diagnosis would not provide affirmation of their clinical reasoning. In contrast, in a low uncertainty avoidance culture ambiguity is welcomed and mistakes are considered part of the learning process.³⁶ In this culture, conflict can be utilized constructively and multiple hypothetical diagnoses considered without creating anxiety in learners.

Hofstede also discusses culture in terms of collectivist and individualist. In collectivist cultures, teachers have authority and their role is to provide knowledge.^{34,36} The group or class is responsible for obtaining knowledge and success is defined by group performance. Individual students tend to only speak up when called upon by the teacher and are more comfortable discussing opinions in small groups. However, the dynamic of a small group may challenge the student to demonstrate individual accountability. In individualist cultures, students often perform self-directed learning and do not fear expressing ideas in a group setting.³⁵

Hofstede further describes culture in reference to how masculinity and femininity traits are valued and revealed.³⁴ In masculine cultures, there are clearly defined social status roles. Students strive to be the best. In comparison, feminine cultures are nurturing and the average student is considered the standard. Kenyan society can be described from this perspective as a masculine society.³⁴

Findyarini, Hawthorne, McColl and Chiavaroli explored the clinical reasoning processes used by students at an Indonesian medical school and compared these to medical students in an Australian University.³⁵ Indonesia is similar to Kenya on three of the four cultural dimensions.³⁷ Both Indonesia and Kenya are considered to

have the following characteristics: high power distance, uncertainty avoidance, and collectivist culture. In contrast, Kenya is considered to be a masculine society and Indonesia is considered feminine.

In the Findyarini et al. study, the 41-item Diagnostic Thinking Inventory (DTI) was utilized at semesters 6 and 12 to measure the medical student's degree of flexibility in thinking and knowledge structure in memory. In addition, individual interviews and focus groups were performed with teachers and medical students. Eighteen students were recruited from each medical school for the study. Twenty-four interviews with teachers were also performed.³⁵

There were no significant differences in DTI scores between the two medical schools.³⁵ Two themes did emerge from the qualitative data, power distance and uncertainty avoidance. The teachers and students at the Indonesian medical school emphasized the teacher's content expertise as a source of information.³⁵ In contrast, the Australian students viewed the teachers as a facilitator. Furthermore, Australian students discussed the importance of the patient's contribution to the clinical reasoning process. Indonesian students did not mention collaboration with the patient to determine a diagnosis.³⁵ The Indonesian students discussed difficulty with problem-based learning and discussed the challenge of dealing with uncertainty and self-directed learning through a patient case. In contrast, Australian students and teachers felt problem based learning enhanced clinical reasoning skills. Furthermore, Australian teachers discussed the introduction of pattern recognition as a clinical reasoning approach.³⁵ Indonesian teachers did not discuss pattern

recognition. The authors concluded that cultural issues must be taken into consideration when implementing teaching and learning strategies.³⁵

Clinical Reasoning Outcome Measurement

Due to the variety of clinical reasoning processes utilized by physical therapists, assessments of clinical reasoning must be able to evaluate key elements in each model. The hypothetical-deductive reasoning process requires assessment of the ability to gather cues from the examination to develop and reassess a working hypothesis. The assessment tool should be able to measure the collection of key information within the patient's subjective history, tests and measures performed during the physical examination, development of reevaluation methodology as well as a treatment plan based on the patient's impairments.²¹ The pattern recognition model concentrates on the unseen intellectual development of a diagnosis based on experience.²¹ The establishment of the pattern and development of a hypothetical diagnosis would need to be described by the physical therapist in order to be assessed.²¹ Finally, the narrative reasoning process can only be evaluated through the observation of the therapist's interaction with the patient to determine if a shared understanding of the patient's perspective was reached to gain an inclusive view of the patients impairments.²¹ Thus, the narrative reasoning process necessitates an interpretive approach to explore themes and constructs.²⁵ It requires the perceptions of both the clinician and patient be explored within the context of the therapy session.

The current viewpoint on the assessment of clinical reasoning in healthcare professions incorporates authentic assessments and qualitative assessments to capture an individual's clinical reasoning versus the use of a single instrument.⁷ The most common authentic assessments of clinical reasoning in physical therapy include multiple choice examinations, narrative written examinations, and live patient examinations.³⁵⁻⁴¹

The Health Science Reasoning Test (HSRT) is a 33 item multiple-choice examination designed to assess the critical thinking of professional students in healthcare.³⁸ This test provides an overall score and five subscale scores. The five subscales include: analysis and interpretation, inference, evaluation and explanation, deductive reasoning, and inductive reasoning. To determine the construct validity or the ability of the HSRT to differentiate novice from expert physical therapists, Huhn et al. administered the exam to both first year physical therapy students and physical therapists with specialist certification.³⁸ The results demonstrated that experts (n=73) scored significantly better than the students (n=79) in two of the five subscales, analysis and interpretation and deductive reasoning.³⁸ There was also a statistically significant difference between student and expert physical therapists in overall scores on the exam. However, following completion of the didactic portion of the physical therapy program, student scores were not significantly different than the scores of the experts.³⁸ These findings suggest there is limited utility of the HSRT examination in assessing the progression of clinical reasoning of physical therapists following entry-level education.

The Think Aloud Standardized Patient Examination (TASPE) has been developed for utilization in simulated clinical environments with standardized patients to determine clinical reasoning competency in student physical therapists.³⁹ The TASPE is based on the hypothetical-deductive reasoning model consisting of cue acquisition to generate multiple hypothetical diagnosis early in the patient encounter, use of initial hypothesis to guide further inquiries, and hypothesis evaluation.³⁹ To assess the clinical reasoning process, students are asked to verbalize their thoughts either during or immediately following a patient encounter.

During the TAPSE, students are asked to verbally describe their clinical reasoning without input from the standardized patient.³⁹ Scores are based on three performance criteria focused on the students' ability to recognize relevant information and effectively utilize this information to determine the next appropriate step in the evaluation and treatment of the standardized patient.³⁹ The three performance criteria include; justifying hypotheses following the subjective interview, justifying hypotheses following the examination of the patient, and justifying treatment interventions based on the clinical presentation. Scores on each item on the TASPE range from 0 (poorly) to 3 (extremely well). The score of poorly describes the inability to recognize key clinical information to justify decision making and a score of extremely well describes the ability to differentiate information important for the diagnosis and treatment of patients.³⁹

Fu explored the interrater reliability of the TAPSE through examining clinical reasoning of 28 doctor of physical therapy students.³⁹ In this study, students were

videotaped performing an examination and evaluation of a standardized patient with a musculoskeletal complaint. One of four onsite examiners assessed the student's live performance on the examination and an independent examiner assessed the student's videotaped examinations. The weighted kappa for the think out loud items between the independent examiner and each of the four onsite examiners ranged from -0.50 to 0.92.³⁹ Spearman rho per examiner pair ranged between 0.63 and 0.98. One examiner pair was excluded from the calculation of Spearman rho due to lack of a monotonic relationship in the scores.³⁹ This suggests variability in the interrater reliability based on the examiners. A limitation of the study included the relatively small sample size from a single physical therapy program.

A variation of the TASPE was used by Gilliland to explore the usefulness of the TASPE in measuring student progression in clinical reasoning skills. In this study, clinical reasoning strategies of first and third year physical therapy students were compared.⁴⁰ A random sample of six first year students and six third year students were utilized in the study.

Rather than using a simulated patient for the students to assess, Gilliland provided written descriptions of a patient case to facilitate cue acquisition. The students were encouraged to think out loud during a hypothetical patient assessment. A patient case, describing adhesive capsulitis, was read to each student, who was able to ask questions about the patient presentation.⁴⁰ The student was then asked to provide an assessment including hypothetical diagnoses and treatment plans for the patient. The students were permitted to take written notes

during the process. Once the case had been presented verbally, the students were provided the full written case for review and were allowed to reassess their final hypothetical diagnosis.⁴⁰

Following the assessment, one-on-one interviews were performed with the students to allow the students to explain mental processes related with clinical reasoning that were not presented during the case. All patient assessments and student interviews were audiotaped and transcribed. Coding of the information included the number of cues gathered by the student based on the tests and measures defined by the *APTA Guide to Physical Therapist Practice*.⁴⁰ Each hypothesis presented by the student was coded based on the ICF diagnostic category by the investigator.

First and third year students generated the same number of hypotheses, however, third year students reconsidered the hypotheses three times as often.⁴⁰ This study suggests third year students utilize the fourth process in the hypothetical-deductive model, hypotheses evaluation, to a greater extent than first year students. Third year students were also able to collect the necessary diagnostic information much more effectively than first year students.⁴⁰ First year students had difficulty distinguishing critical and non-critical information during the assessment. Four first year students utilized a single piece of information to determine a hypothetical diagnosis and two ignored any information that did not support their primary diagnosis.⁴⁰

It was determined that third year students combined two clinical reasoning strategies, the hypothetical-deductive and pattern recognition.⁴⁰ Since this was a

paper case, the students did not have the opportunity to utilize the narrative reasoning process. Limitations to the study included a small sample size and possible bias in the interpretation of the qualitative results with the researcher being familiar with all participants. Furthermore, the pattern recognition descriptions provided in the student narratives represent the clinical identifiers for adhesive capsulitis.⁴¹ This may indicate knowledge attainment versus the use of pattern recognition.

The Clinical Reasoning Reflective Questionnaire (CRRQ) was developed to identify clinical reasoning skills of physical therapy students across the professional curriculum.⁴² It is a six-question survey used to determine the reflective processes utilized by students. The questions were developed to assess three main concepts; metacognitive thinking, struggling with uncertainty, and critical self-reflection and growth.⁴² During the development of the tool, information from the questionnaire was compared to clinical reasoning skills identified in the Clinical Performance Instrument (CPI).⁴²

To determine content validity, the tool was provided to stakeholder groups, including 48 members of a clinical education consortium, to review the items of assessment and scoring of the tool. The revised tool included six items exploring three concepts; factual knowledge, conceptual knowledge, and procedural knowledge.⁴² Three items are completed prior to a practical examination to assess clinical competence and three items are scored following the practical examination. The questions require the student to reflect upon the experience and provide a rationale for the procedures chosen in the practical examination.⁴²

In 2015, Furze et al. utilized responses from the CRRQ and narratives provided within the CPI item 7 (clinical reasoning) to explore the clinical reasoning of professional physical therapy students within a single DPT program.⁴³ Two class cohorts participated in the study (n=97). Data collection occurred at the completion of semesters 4, 6 and 8. The CRRQ was completed prior to and following practical examinations performed with standardized patients at the end of each semester.⁴³

In this study, CPI data was reviewed following each clinical experience. Three-week clinical experiences occurred between each semester and two full-time, twenty week and sixteen-week experiences occurred at the completion of semesters 7 and 8. Narrative responses from the CRRQ and qualitative data from the CPI (item 7) were analyzed using the constant comparative method.⁴³ Eight themes emerged across the curriculum; (1) focus on self, (2) compartmentalized thinking, (3) limited acceptance of responsibility, (4) procedural performance, (5) recognizing and using case content, (6) improved reflection on performance, (7) dynamic patient interaction, and (8) integrating situational awareness.⁴³

The narrative data collected indicated that students continue to develop clinical reasoning skills throughout the physical therapy curriculum. Initially, clinical reasoning was characterized by compartmentalized thinking with students unable to effectively utilize information gained from the examination to develop a treatment plan for the patient.⁴³ Intermediate level reasoning was characterized by an improved ability to link examination results to procedural performance. However, students continued to demonstrate limited ability to integrate this

information with the patient narrative.⁴³ Students in their final clinical rotation demonstrated a dynamic patient interaction and were able to integrate the treatment with the patients unique situation.⁴³

Furze et al.'s findings are supported by previous studies that found differences in clinical reasoning when comparing expert and novice physical therapy clinicians.^{19,33} According to these studies, expert clinicians are better able to build upon the patients' responses, integrate verbal and tactile cues, and incorporate the patients' unique social context into the treatment plan.⁴³ Limitations to Furze et al.'s study included the use of a single program that limited generalizability.⁴³ The variability in complexity of the patient cases used for the practical examinations, based on student's progress through the curriculum, limited reliability of the findings.

Specific to post-graduate physical therapy education, attempts have been made to develop assessment criteria to evaluate clinical reasoning in the expert physical therapist. Yueng et al, used a modified Delphi study to conduct an international consensus building study utilizing experts from 22 countries that offered post-graduate education in orthopaedic manual physical therapy.⁴⁴ Rather than utilizing a panel of experts, the study sought to include information from educators from all 22 member organizations within the International Federation of Orthopaedic Manipulative Physical Therapists.

A total of 80 assessment criteria were generated for the initial Delphi questionnaire based on a review of published literature on clinical reasoning. The assessment criteria were developed by the Yueng, the primary investigator.⁴⁴ One

hundred thirty two respondents were asked to rate each of the 80 criteria on a 4 point scale ranging from extremely important to not at all important.⁴⁴ In addition, respondents were asked to generate criteria not included on the list. A total of nine items were removed due to noted redundancies and low mean ratings. A second round of review was performed with the 71 remaining items with the goal of reducing assessment criteria to a manageable number for use in an assessment tool.⁴⁴

Fifty respondents from the first round review participated in the second round. A nine-point scale was utilized in the second round with the scale ranging from not at all important to extremely important. Items that did not receive at least a 70% agreement from respondents regarding the high importance of the item were removed.⁴⁴ Following the second round, the number of assessment criteria was reduced to 53. A third round of review was performed to finalize the assessment criteria. Thirty-four respondents from round two participated in the third round of questionnaires. Consensus was determined to be 70% agreement regarding importance of the item and assessment feasibility.⁴⁴

The final assessment criteria from round three were placed into seven subgroups including; (1) attainment of data, (2) generation of hypothesis, (3) evidence-based practice, (4) knowledge and application of biomedical, (5) clinical and behavioral sciences, (6) critical use of knowledge, and (7) communication skills.⁴⁴ High internal consistency of the items in each of the seven subgroups was found. Furthermore, the participants in the Delphi questionnaire process agreed that the criteria could be utilized for assessment of clinical reasoning skills.⁴⁴

Written assessments for clinical reasoning have been proposed utilizing the Case History Assessment Tool (CHAT).⁴⁵ The CHAT is a standardized assessment tool developed to be utilized in the Canadian manual therapy certification process. The Orthopaedic Manual Physical Therapy (OMPT) certification examination is a short answer, written examination in which residents assess paper based cases.⁴⁵ The CHAT is comprised of 16 questions derived from 45 items of Yeung's clinical reasoning criteria.⁴⁵ The questions ask residents to note level of irritability, nature of the disorder, and possible yellow flags. This information is then utilized to determine appropriate outcome tools, tests and measures, and interventions to be performed.⁴⁵ The rating scale for each item included excellent, acceptable, and unacceptable.⁴⁵

A mixed methods study was performed by Yueng et al. to determine the feasibility of the CHAT tool for the assessment of clinical reasoning.⁴⁵ A sample of convenience was utilized in this study. Eleven Canadian examiners for the (OMPT) certification test served as reviewers to score a completed certification examination. The CHAT was used to assess residents' ability to rationalize information gained in a case based history and examination to develop a hypothetical diagnosis.⁴⁵

Following the scoring of the examination, examiners were asked to complete a survey on the sensibility of the questionnaire. A seven-item scale was utilized to rate the CHAT on purpose, feasibility and acceptability. Semi-structured, one-on-one, telephone interviews were performed with each participant following the examination.⁴⁵ Participants were asked their perceptions of the proposed scoring method. Participants noted few redundancies in the CHAT. A number of

participants felt a three item rating scale was too constraining and required significant subjectivity.⁴⁵ The authors concluded there was general acceptance of the use of the CHAT for the assessment of clinical reasoning using a short answer written exam.⁴⁵ Limitations of the study included a small sample size and a variety of opinions on feasibility and usefulness of the tool among the participants. The study explored the feasibility of utilizing the tool, however, inter and intrarater reliability and the ability of the tool to assess the progression of clinical reasoning skills have not been reported.

As opposed to using written exams for clinical reasoning assessment, clinical reasoning skills in medicine have been found to be context specific.⁴⁶ The context or environment in which the process takes place is an important variable in determining a treatment plan. The context specificity can be explained by two psychological theories, cognition and ecological.⁴⁶ These theories have been utilized to describe how clinical reasoning is impacted by contextual influences including the participants, settings and their interactions.⁴⁶ Cognition psychology divides the clinical encounter into three separate components: the physician, the patient, and the setting. Ecological psychology discusses what the environment provides to the encounter and what the participant can perform in the environment.⁴⁶ The context would therefore be an important factor in the assessment of clinical reasoning. To incorporate context within the assessment of clinical reasoning, the Practice Dimensions Examination was developed to allow for the interaction of the physical therapist with the patient in a clinical environment.²

The Practice Dimensions Examination (PDE) is based on the Description of Specialty Practice (DSP) in Orthopaedic Physical Therapy published by the APTA.⁴⁷ The DSP is based on the clinical decision making processes and clinical procedures used by advanced practitioners in orthopaedic physical therapy in the United States as determined by a practice analysis.⁴⁷ The DSP defines the body of knowledge and skills deemed necessary for competent practice by experts in the field.⁴⁷ The DSP is also utilized to determine the curricula in accredited orthopaedic residency programs.⁴⁹

The first practice analysis survey was completed in 1983 and revalidated in 1993. A third revision was published in 2002.⁴⁷ The survey resulted in six knowledge areas across six practice dimensions.⁴⁷ The six knowledge areas included: anatomy and physiology, movement science, clinical pathology, orthopaedic interventions, physical therapy theory and practice, and critical inquiry for evidence based practice.⁴⁷ The level of importance placed on the patient evaluation revealed a focus on clinical reasoning as a key determinant of expertise.

The orthopedic DSP was most recently updated in 2015.⁴⁸ The revalidation of the DSP utilized a survey designed by subject matter experts consisting of six certified physical therapists chosen by the American Board of Physical Therapy Specialties (ABPTS) based on gender, geographical area, and practice setting.⁴⁸ The pilot survey was developed based on the 2001 Guide to Physical Therapy Practice, the 2002 DSP for orthopaedic physical therapy, and a review of the literature.⁴⁸ The rating scale utilized on the survey was standardized by the ABPTS. The scale consisted of frequency, importance, and level of judgment or mastery.⁴⁸ The five

sections of the survey included: knowledge areas, professional roles, patient management percentage of body region treated, and demographic information.⁴⁸ The pilot survey was sent to 30 Orthopaedics Certified Specialists (OCS) whom had been involved in board examination activities for the specialization.⁴⁸ Twenty-one respondents rated items in each section. Only minor adaptations were made based on the results of the pilot survey.⁴⁸

The survey was sent to 800 orthopaedic certified specialists and 800 non-certified specialists in the United States.⁴² The noncertified specialists were chosen by membership in the orthopaedic section of the APTA. There were a total of 267 respondents from the specialist group.⁴⁸ Forty- three surveys were incomplete and not included in the analysis. Only 13 noncertified specialists responded to the survey and therefore were not included in the analysis. Based on the survey, 24 items were deleted from the DSP.⁵⁰ Items added to the DSP included: vestibular and visual assessment, outcome tool utilization, and use of patient centered values and ethics.⁴⁸ A separate subcategory was also added for special tests under knowledge areas.⁴⁸ Limitations to the current revalidation study included the low response rate to the survey.

The Practice Dimensions Examination (PDE) is based on the DSP. It was initially developed by the Kaiser Permanente Southern California Orthopaedic Physical Therapy Residency to evaluate a resident's clinical knowledge, reasoning, movement analysis, psychomotor/manual, communication, and movement training skills during direct (live) patient care activities.² A component of the performance evaluation was to assess the resident's clinical reasoning skills of analyzing,

interpreting, and summarizing the emerging data collected during their examination (or re-evaluation) and treatment of patients.² The interview portion of the examination allows for the resident to explain the mental processes of clinical reasoning that are not observable to the examiner. The PDE assesses the physical therapist's ability to collect key information, integrate the information into a previous knowledge framework to develop a diagnosis and prognosis, and select appropriate interventions based on this assessment.² The assessment is divided into five categories: examination, evaluation, diagnosis, prognosis, and intervention. Each category is further divided into multiple skills to allow for a measurable assessment of each skill component.² The assessment form originally contained a total of 81 items or skills.

A pilot study was performed by Cunningham et al. to investigate the psychometric properties of the PDE assessment tool.² To determine if the tool could differentiate between residency graduates and physical therapists without advanced training, a cross-sectional design was utilized in which 12 graduating residents and 10 physical therapists entering a residency program in Kenya completed a live patient practical examination.² Inclusion criteria included participation in or acceptance to the residency program, practice as a physical therapist between three and 25 years, and 50% of the work day spent in direct patient care.² The examinations were performed over a 5-day period in Nairobi, Kenya at the Kenya Medical Training College. Two examiners, previously assessed for interrater reliability on the PDE, performed the assessments.²

Descriptive statistics, including frequency counts for each of the 81 items on the examination, were determined. Cronbach's alpha was utilized to determine internal consistency for items in each of the categories: examination 0.871, evaluation 0.818, diagnosis 0.836, prognosis 0.603 and intervention 0.824.² In addition, overall pass rates were analyzed using the Pearson chi-square and Fisher's exact test to determine if the graduating residents achieved significantly higher scores than those of physical therapists entering the residency program. Graduating residents achieved an average score of 83.4% on the live patient examination with an overall pass rate of 92.3%.² Physical therapists entering the residency program achieved an average score of 38.2% with an overall passing rate of 0.00%.² The computed chi-square value was 19.30 with an associated *p*-value less than 0.001. A Fisher's exact test demonstrated a two-tailed *P* value less than 0.001.² The results of the pilot study suggest the tool can differentiate between levels of development of clinical reasoning.

The above live patient examinations were video recorded and utilized to examine the inter and intra-rater reliability of the PDE.⁴⁹ Two months following the practical examinations performed in Kenya, the two original assessors reviewed and scored 18 video recorded live patient examinations.⁴⁹ The intra-rater reliability for overall pass rate was determined through percent agreement (83.3%) and a related samples McNemar test (*p*=1.00).

Of the 81 items on the original examination, 17 items were determined to not be applicable to the residents in Kenya.⁴⁹ Fifteen of the 17 items related to access to treatment modalities and equipment not commonly found in the clinical setting. To

improve the interrater reliability of the PDE, the 64 remaining items were re-addressed for consistency in the understanding of adequate performance of the skill by a team of four therapists familiar with the assessment tool.⁴⁹ Descriptions of adequate performance of the skill were added to those items demonstrating a kappa score less than 0.400 to improve agreement.

The revised examination was pilot tested with two blinded assessors utilizing video recordings of 16 residents.⁴⁹ The revised Practice Dimensions Examination demonstrated an interrater reliability of 87.5 % agreement with a kappa of 0.714 for overall pass rate.⁴⁵ Nineteen of the items continued to demonstrate limited reliability with either a percent agreement less than 75% or kappa value less than 0.400.⁴⁹

A third interrater reliability study was performed by Cunningham et al. in October 2016 with seven graduating residents and seven physical therapists awaiting entry into the residency program in Nairobi, Kenya.⁴⁹ The two examiners from the previous interrater reliability study participated in the assessment of the therapists. Fifty-eight of the items demonstrated an interrater reliability above a kappa of 0.650 or a significance less than or equal to 0.001.⁴⁹ In the category of examination, there was limited agreement on the item regarding satisfactory performance of passive range of motion. The evaluation category demonstrated four items with limited agreement including determining contraindications for treatment, identifying the type and nature of the patient's problem, developing a working diagnosis, and responding to emerging data by redirecting treatment.⁴⁹ Under the category of prognosis, limited agreement existed for choosing reassessment procedures for the long-term response to therapy. The category of intervention, limited agreement was present for adequate

performance of soft tissue mobilization. Overall, there was a 93.3 percent agreement on the determination of adequate performance to pass the examination with a kappa of 0.831 (0.001).⁴⁹

Summary

Clinical reasoning in physical therapy has been described as the ability to gather and interpret relevant data in order to provide the optimal treatment for the presenting patient.¹⁹ Clinical reasoning strategies recognized in physical therapy have included hypothetical-deductive reasoning, pattern recognition, and narrative reasoning.^{19,21} Furthermore, there appears to be an intrinsic relationship between each of the clinical reasoning strategies and clinical experience. Expert clinicians use a variety of strategies to improve differential diagnosis and progression of treatment plans for patients.^{19,21}

Multiple assessment tools have been suggested for the measurement of clinical reasoning. The HRST and CHAT utilize written examinations limiting the influence of context and patient interaction in the assessment of clinical reasoning.^{39,44} The TAPSE, although initially described for use in a standardized patient examination, has been investigated only by utilizing written case studies.⁴² The PDE, chosen to be utilized in the current study, incorporates context or environment and interaction with the patient through a live patient examination. This allows for the assessment of narrative reasoning in addition to the hypothetical-deductive and pattern recognition models. The PDE integrates an interview session with the resident to assess the mental component of clinical

reasoning that cannot directly be observed. Furthermore, initial pilot studies with the PDE suggest that it is a valid and reliable tool.⁴⁹

The Contribution this Study Will Make

Although it is theoretically accepted that residency education will contribute to the advancement of clinical reasoning, limited studies have investigated the effect of residency programs on the clinical reasoning development of physical therapists.⁴⁻⁶ The studies have been limited to survey tools provided to residency graduates. This study utilized an authentic assessment to examine the Kenyan residency graduates' advancement of knowledge and clinical reasoning through participation in an 18-month residency program modeled after those in the United States.

The residency program in Kenya is a novel approach to providing advanced education in a developing country. Therefore, in addition to examining the knowledge and clinical reasoning development through participation in the residency, a survey of participants who have completed the residency was conducted to explore how the residency influenced clinical practice and career advancement. Furthermore, individual interviews with the residents following completion of the final practical examination sought to identify barriers that influenced participation in the residency program. How participants perceived the residency program fostered the use of new skills in the clinical environment was also explored.

The results of this study will add to the limited knowledge regarding development of clinical reasoning through residency training and utility of a post-graduate physical therapy orthopedic residency program in developing countries with limited educational and financial resources. The development of programs that influence the ability of existing physical therapists in developing countries to provide treatment efficiently and effectively may ultimately assist in serving physical therapy needs of the wider community.

Chapter 3: Methodology

Introduction

The purpose of this chapter is to present the methodology implemented throughout the research study. This chapter contains information on the subjects who participated in the study, the research designs employed, the data collection instruments and process, the data analysis techniques, information regarding the resources employed, and limitations of the study.

Research Design

This study utilized a mixed methods research design to explore the influence of an orthopaedic manual therapy residency program in Kenya on the progression of clinical reasoning skills, professional development, and career advancement. In addition, semi-structured interviews explored barriers to participation in the residency program and the programs ability to foster the use of new skills in the clinic from the participant's perspective. A sample of convenience was utilized consisting of graduates from a residency program in Nairobi, Kenya.

An authentic assessment of clinical reasoning was performed by two experienced examiners from the United States through a live patient practical examination at the initiation of the program and 18 months later at completion of the residency program. In addition, interviews following the practical examination enabled the residents to describe their clinical reasoning process. Barriers to participation in the program and utilization of new skills in the clinic were also

explored through the individual interviews with the residents. Professional development and career advancement were measured through a survey provided to the residents at the completion of the program.

Methods

Study Approval

Approval for this study was received from the Kenya Medical Training College Ethics and Research Committee, the Institutional Review Board of Radford University, and Institutional Review Board of Nova Southeastern University. Informed consent was obtained prior to initiation of the study and the rights and confidentiality of the participants were protected throughout the study. The documentation of informed consent for the residents is provided in Appendix H.

Subjects

This study utilized a sample of convenience of residents in the third and fourth cohorts of an orthopaedic manual therapy residency program in Nairobi, Kenya. All residents were over 18 years old and could speak and read the English language and all courses taught in their physical therapy academic program were provided in English. The residency program was chosen based on the unique characteristics of the participants that limited the introduction of covariates into the study. Inclusion criteria included the participants not having access to or completed continuing education courses related to physical therapy throughout their careers, and all residents entering and completing the program at a three-year technical level of physical therapy education. Inclusion criteria also included consent for participation.

Subjects included residents in the third (n=14), and fourth (n=13) cohorts of the orthopaedic manual therapy residency program in Kenya. The median age of participants in the study was 29.0 years and the median number of years practicing as a physical therapist was 5 years. The majority of residents described their practice setting as being a generalist, providing patient care in a variety of settings including inpatient and outpatient settings and outpatient orthopaedic settings. Two of the 27 participants described their practice setting as being primarily in pediatrics. Two residents in the third cohort had received mentoring by a chiropractor prior to entering the residency program. The two residents were employed by a chiropractor trained in Great Britain. They were instructed in examination procedures and select manual therapy techniques.

Residency Program Overview

The residency program consists of six onsite modules offered over 18 months. Residents complete a live patient examination at the initiation of the residency program to assess baseline skills and clinical reasoning. The online didactic portion of the program utilizes the Clinical Practice Guidelines and Current Concepts in Orthopedics, 3rd edition (American Physical Therapy Association) as background reading and preparation for participation in onsite modules.¹¹ Each module consists of ten days of onsite education and mentoring provided by physical therapy instructors from the United States. Instructor qualifications include being a faculty member currently teaching orthopaedic content within an accredited professional physical therapy program in the United States; or being both an Orthopaedic Certified Specialist and a Fellow of the American Academy of

Orthopaedic Manual Physical Therapists. There are currently 50 volunteer instructors participating in the program. The Jackson Clinics Foundation provides the cost of airfare for the volunteers, and housing is provided through KMTC.¹¹

The residents participate in six onsite modules. The purpose of each module is to provide the residents with didactic education and clinical skills consistent with the orthopaedic curriculum provided by professional doctorate in physical therapy programs in the United States.¹³ To ensure consistency throughout the residency program, a standardized curriculum was provided to the instructors including skills to be instructed and written examinations. In addition to onsite modules and online resources, residents receive between three and forty hours of clinical mentoring focused on integrating the knowledge and skills learned during the residency program into clinical practice.¹¹ Mentoring is largely determined by the resident's physical location in the country and access to Nairobi. Mentors do not travel to the border of Somalia due to security reasons. To progress in the program, residents must achieve adequate performance on a written and a practical examination provided at the completion of each module. Instructors assigned to the respective onsite module performed the module examinations.

Following completion of the didactic portion and six onsite modules of the 18-month residency program, residents must successfully pass a comprehensive written examination and a live patient practical examination to fulfill the requirements of the Higher Diploma.¹¹ The final examinations are administered by the founder of the program, Richard Jackson, and a second residency instructor based in the United States. KMTC grants a Higher Diploma in Orthopaedic Manual

Therapy to successful graduates of the residency program. A curriculum overview is provided in Appendix A.

Pilot Study

A pilot study was conducted in October 2014, to determine the influence of the residency program on the participant's knowledge, clinical reasoning, and psychomotor skills related to the examination and evaluation of musculoskeletal conditions. Residents of the first and third cohorts of the residency program served as subjects for the pilot study, which compared the performance on the PDE by the graduating residents to physical therapists waiting to enter the program. The pilot study was approved by the Kenya Medical Training College Ethics and Research Committee and the University of Evansville Institutional Review Board.²

Prior to initiating the pilot study, investigators oriented residents to the study, informing the residents that participation was voluntary and that the residency instructors would not have access to information regarding which residents consented to the study.² Following an explanation of the purpose of the research study, all residents were offered consent forms to allow the investigators access to demographic information and the practical examination assessment forms. In addition, consent was obtained for the practical examinations to be videotaped for future assessment of intra rater reliability. All residents received the same assessment, regardless of consent, as a component of the residency program. Following the live patient practical examination, participants were invited to participate in one-on-one interviews to explore the clinical reasoning process utilized during the examination and evaluation of the patient. All 15 residents in the

first cohort and 17 physical therapists, entering the third cohort of the program, consented to participate in the pilot study.²

Consenting residents agreed to the assessment of baseline skills conducted by two examiners. The examiners were blinded to the resident's status in the residency program and scores on the examination did not influence the resident's progression in the program. The scores from the primary examiner were maintained by the residency program as the official baseline measurement.² Following the examination, residents were individually interviewed to gain an understanding of the clinical reasoning process they utilized in the practical examination. Consent forms and baseline assessment forms for the consenting residents were maintained in separate locked cabinets at Radford University within the physical therapy department.

Consent

Prior to the start of the live patient examinations in October 2016, the primary investigator visited the third and fourth cohorts of the orthopaedic manual therapy residency program in Kenya to discuss the purpose of the study, procedures associated with the study (utilization of the practical examination scores, survey completion, and individual audiotaped interviews), and requirements for time involvement up to 50 minutes. The primary investigator of the current study asked residents in the third cohort of the program for consent to access the assessment forms documenting the results of the practical examinations performed in October 2016. The investigator explained that consent was voluntary and that residency instructors would not have access to information regarding which residents

provided consent. At the time, residents were informed they would receive the same assessment for the final practical examination, regardless of consent, as a component of the residency program. All residents in the third and fourth cohorts of the program agreed to participate in the study. To maintain confidentiality, each consenting resident was assigned a participant number for identification purposes throughout data collection to protect the anonymity of the participant. This identification number for residents in the third cohort was matched to the original identification number provided in October 2014.

The practical examination assessment forms, surveys, and audiotaped interviews were collected and maintained by the primary investigator. Upon the primary investigator's return to the United States, the information collected was secured in a locked cabinet within a locked office on Radford University's campus within the department of physical therapy. The PDE assessment forms of consenting residents completing live patient practical examinations in October 2016, demographic information, surveys, and transcribed interviews are stored in the same locked cabinet. These records will be maintained for a minimal period of 6 years following completion of the study. Informed consent forms with the participants' names and identification numbers are stored in a second locked cabinet. The following appendices are provided; Appendix A- residency curriculum overview, Appendix B- Practice Dimensions Examination, Appendix C- frequency counts for items on the PDE, Appendix D- resident scores on the PDE prior to and following the completion of the residency program, Appendix E- professional development and career advancement survey, Appendix F- subject demographic

information intake form, Appendix G- graduating resident interview guide, Appendix H-documentation of informed consent for residents, and Appendix I- documentation of informed consent patients.

Quasi-experimental design: Authentic assessment of clinical reasoning

Live patient examinations were conducted over a one-week period at KMTC in Nairobi, Kenya. In October of 2016, 14 of the original 17 residents in the third cohort performed a final live patient practical examination as a requirement for successful completion of the orthopaedic manual therapy program. Three residents had not successfully completed all six onsite modules and were not eligible to take the final examination. All residents provided consent for participation in the study. The clinical skills assessed included examination, evaluation, diagnosis, prognosis, and intervention. Following completion of all examinations, the investigators compared the baseline and final live patient practical examinations. Data collected during the pilot study in 2014 provided the baseline for comparison with scores collected at the final practical examination.

The assessment of the final practical examinations was performed by the two examiners utilized in the pilot study baseline assessment of residents in October 2014. The examiners are current instructors in a United States residency program and have extensive experience in scoring the assessment tool. The examiners did not instruct or provide mentoring to the individual cohort of residents in the Kenya program.

The final practical examinations were scheduled for 60 minutes for each resident. Two examination rooms at KMTC were reserved for the use of the

residents during this period. The PDE was utilized to score the residents performance. Scores on the 64 PDE items utilized in this study included unsatisfactory performance, satisfactory performance, and not applicable. The Practice Dimensions examination is provided in Appendix B. A score of 75% on the final live patient practical examination is a requirement for successful completion of the residency program.

Non-experimental Survey Design: Professional development and career advancement

Following the practical examination and receipt of informed consent, graduating residents (third and fourth residency cohorts) completed a nineteen - question survey regarding the impact of the residency program on resident's clinical practice and career advancement. The survey was adapted from previously published outcomes of residency training in the United States.^{4,5,18} The survey can be found in Appendix E. Information from the survey was utilized to assist in determining the value and immediate influence of the residency on professional development and career advancement of the graduating resident.

Qualitative Design: Participants' perceptions of the residency program

Immediately following the practical examination and receipt of informed consent, residents in the third and fourth cohorts were recruited to participate in individual, one-on-one interviews. The primary investigator performed the interviews. The primary investigator had sought consent from the residents for the 2014 pilot study and then had no further contact with the residents. The primary

investigator used open-ended questions to probe the participant's and guide the interviews. The interview guide is located in Appendix G. Interviews were performed on site at KMTC in a private treatment room. Consent was obtained for all interviews to be recorded and transcribed by an independent transcriptionist to ensure accuracy.

Data Collection Instruments

Practice Dimensions Examination

The PDE assesses the physical therapist's ability to collect key information, integrate the information into a previous knowledge framework to develop a diagnosis and prognosis, and select appropriate interventions based on this assessment.² The assessment is divided into five categories: examination, evaluation, diagnosis, prognosis, and intervention. Each category is further divided into multiple skills to allow for a measurable assessment of each component.⁹ The assessment form contains a total of 64 items or skills. Internal consistency of the items in each of the categories has been determined through a pilot study performed in Nairobi, Kenya by Cunningham et al.² Cronbach's alpha for each category includes: examination 0.871, evaluation 0.818, diagnosis 0.836, prognosis 0.603, and intervention 0.824.² Interrater reliability of the items on the PDE was determined through a kappa analysis. Fifty-eight of the 64 items on the PDE demonstrate a kappa of .0650 or greater.⁴⁹ In addition, the PDE was able to distinguish between physical therapists without specialty training and physical therapists that had completed a residency program. Cunningham et al. found following completion of a residency program, physical therapists scored an average

of 83.4% on the PDE. This compared to an overall score of 38.2% for physical therapists with similar years of experience without specialty training.² The PDE can be found in Appendix B.

Professional Development and Career Advancement Survey

The professional development survey utilized in this study is based on a questionnaires created by Smith et al. and Jones et al. to determine the impact of a residency program on the professional development of residents in the United States.^{4,5} The survey was adapted by instructors in the Kenya residency program to assist with the interpretation of items by physical therapists in Kenya. The adapted survey included demographic information and nineteen items related to the residents' professional development and career advancement. The survey utilized a five point Likert scale ranging from major positive to major negative.¹⁸ Cronbach's alpha for the questions regarding professional development was 0.864 and 0.712 for the questions regarding career advancement.¹⁸ The professional development and career advancement survey is included in Appendix E.

Statistical Analysis

A mixed methods research design was utilized in this study. Statistical analysis of quantitative data was performed using SPSS 22. Descriptive statistics, including frequency counts for each of the 64 items on the PDE, were utilized to describe the residents' performance. Each skill was analyzed for significant differences between the two assessments, baseline and graduating scores.

Furthermore, overall pass rates were analyzed using the Wilcoxon signed rank test to determine if graduating residents achieved significantly higher scores as compared to baseline measures taken at time of entry into the residency program.

To determine the value and influence of the residency on professional development and career advancement, median values were determined for each of the survey questions. Cronbach's alpha was performed for the 12 questions related to professional development, as well as for the seven questions related to the influence of residency program on career advancement.

Qualitative Analysis

A phenomenology approach was utilized to analyze the data. All interviews were transcribed by an independent transcriptionist to ensure accuracy. The transcripts and recordings were reviewed by the primary investigator prior to analysis. The information from semi-structured individual interviews was coded and general themes identified by the primary investigator. NVivo for Mac was utilized to arrange codes. Thick descriptions and narratives of the participants have been provided to inform the themes. To ensure credibility of the themes, all themes were confirmed through peer review by a member of the research study team with extensive qualitative research expertise. Furthermore, peer review of the data was used to identify potential bias on the part of the primary investigator. Member checks were performed with 10 of the residents. The themes from the interviews were triangulated with outcomes from the live patient examination and professional development surveys.

Resources

Human resources included the 14 residents in the third cohort, 13 residents in the fourth cohort, and two examiners employed by the Jackson Clinics Foundation that assessed the live- patient practical examinations. An individual to coordinate and monitor components of the study was necessary and employed to ensure all components were performed in an efficient manner. A technician employed by the KMTTC physical therapy department assisted with the coordination. In addition, 14 patients were recruited by the KMTTC Director of Physiotherapy to serve as patients for the final practical examination.

All patients utilized for the final practical examination could speak and understand English language. Information regarding the practical examinations and associated study was provided to patients on a wait list for an evaluation at the KMTTC outpatient department through use of a recruitment flyer. All patients were screened by the Director of Physical Therapy at KMTTC to ensure there were no contraindications to participation in a full physical therapy evaluation and examination. The screening examinations occurred in English to ensure patients were able to communicate with the residents during the final practical examination.

The primary investigators met with the patients prior to the practical examination to explain the purpose of the study, procedures associated with the study (examination by a resident), and requirements for time involvement. Following an explanation of the purpose of the research study, patients were given the opportunity to ask questions. Patients were provided with consent forms to agree to their assessment being performed by a resident and to permit assessment

of the practical examination results for the purpose of this research study. The documentation of informed consent for the patient is located in appendix I.

Summary

This study utilized a mixed methods research design to explore the influence of an orthopaedic manual therapy residency program in Kenya. The progression of clinical reasoning skills was measured through performance of the PDE during a live patient practical examination at baseline, prior to entering the residency program, and at completion of the residency training. Descriptive statistics, including frequency counts for each of the 64 items on the PDE, were utilized to describe the residents' performance. Each skill was analyzed for significant differences between the two assessments, baseline and graduating scores.

A survey was utilized to examine the influence of the residency training on professional development and career advancement. Median values were determined for each of the survey questions. Information from the survey was utilized to assist in determining the value and immediate influence of the residency on professional development of the graduating resident.

In addition, semi structured interviews explored barriers to participation in the residency program and the programs ability to foster the use of new skills in the clinic from the participant's perspective. The phenomenological approach was utilized to analyze the data. The constant comparative method was utilized for primary coding, followed by secondary cycle coding to identify patterns and themes. Thick descriptions and narratives of the participants have been provided to inform the themes. To ensure credibility of the themes, all themes were confirmed through

peer review by a member of the research study team with extensive qualitative research expertise. Furthermore, peer review of the data was used to identify potential bias on the part of the primary investigator.

Chapter 4: Results

Introduction

The purpose of this study was threefold. The first objective was to describe the outcomes of a post-graduate orthopaedic manual therapy residency program on development of knowledge and clinical reasoning by physical therapists in Nairobi, Kenya. The second objective was to explore the effect of the residency program on the participants' professional development and career advancement. The last objective was to explore from the participant's perspectives (a) barriers that affected participation in the residency program, (b) the residency program's ability to foster the use of new skills in the clinical environment, and (c) barriers to integrating concepts and skills gained during the residency program into clinical practice. Due to the mixed methods used in the study design, each of the three research questions will be addressed individually. Objectives one and two were addressed with quantitative methods and objective three was addressed via a qualitative phenomenological design.

Quasi-experimental Results: Assessment of Clinical Reasoning

The PDE was utilized to assess the subject's clinical reasoning process at baseline, upon entering the residency program, and again at completion of the program during the final live patient practical examination. Frequency counts were performed for each item and category on the PDE. Comparisons were made between the baseline and graduation scores using the Wilcoxon matched pairs test and the McNemar's test.

Research Question

Does participation in an 18-month post-graduate orthopaedic manual therapy residency program, following successful completion of a technical diploma, improve participating physical therapists' knowledge, and use of clinical reasoning skills in the examination and evaluation of outpatient orthopedic populations as assessed through a live patient practical examination?

Findings

A total of 14 residents in the third cohort of the residency program completed live patient examinations at the initiation and completion of the residency program and agreed to participate in the study. The mean age of the residents in the third cohort was 32.3 years with 9.0 years of clinical experience. The residents worked in a variety of practices including generalists (standard per sopier), orthopaedics, sports rehabilitation, and pediatrics. Demographic information for the residents in the third cohort of the program is provided in Table 4.1.

Baseline scores on the PDE were obtained from the previously described 2014 pilot study performed by the primary investigator. As noted earlier, the PDE consists of 64 items within five categories: examination, evaluation, diagnosis, prognosis, and intervention. Residents' scores for six of the 64 items at baseline were consistently 'not applicable' for the skill. A score of 'not applicable' would indicate that the assessment or intervention would provide no additional information based on the patient presentation or would be contraindicated for the patient. Frequency counts for each of the 58 remaining items on the examination

were utilized to describe the residents' performance prior to and following completion of the residency program. Frequency counts for each item on the PDE is presented in Appendix C.

Table 4.1. Demographic Information

Characteristics	Cohort 3	Cohort 4	Cohort 3 and 4
Age in years (mean and SD/median)	32.3 (9.1)/29.0	34.1 (11.3)/28.5	33.3 (10.2)/29.0
Gender	9 males 5 Females	6 males 7 females	15 males 12 females
Years Practicing (mean and SD/median)	9.0 (8.5)/ 5.0	10.4 (11.1)/5.0	9.7 (9.8)/ 5.0
Position title	Orthopaedic specialist: 2 *Physiotherapist: 3 Senior physiotherapist: 3 *Physiotherapist II: 3 *Physiotherapist I: 3	Orthopaedic specialist: 0 Physiotherapist: 6 Senior physiotherapist: 5 *Physiotherapist II: 1 *Physiotherapist I:1	Orthopaedic specialist: 2 Physiotherapist: 9 Senior physiotherapist: 8 *Physiotherapist II: 4 *Physiotherapist I: 4
Practice focus [n(%)]	*Standard per sopier: 4(28.6%) Orthopaedics: 8 (57.1%) Sports rehab: 1 (7.1%) Pediatrics: 1 (7.1%)	*Standard per sopier: 6 (46.2%) Orthopaedics: 5 (38.5%) Sports rehab: 1 (7.7%) Pediatrics: 1 (7.7%)	*Standard per sopier: 10 (37.0%) Orthopaedics: 13 (55.6%) Sports rehab: 2 (7.4%) Pediatrics: 2 (7.4%)
Employment status [n(%)]	Full time: 12 (85.7%) Part time: 2 (14.3%) Per diem: 0	Full time: 11 (84.6%) Part time: 1 (7.7%) Per diem: 1 (7.7%)	Full time: 23 (85.2%) Part time: 3 (11.1%) Per diem: 1 (3.7%)
Percent of time spent in each activity [% (mean)]	Patient care: 86.8% (27.9) Teaching: 10.0% (23.5) Research: 2.5% (7.0)	Patient care: 92.4% (18.9) Teaching: 6.5% (17.0) Research: 1.2% (3.7)	Patient care: 89.8% (23.1) Teaching: 8.1% (19.1) Research: 1.8% (5.4)
Number of patient visits in an 8 hour day [mean(SD)]	Inpatient visits: 5.3 (4.5) Outpatient visits: 8.3 (4.1) Home health visits: 1.7 (1.7) Other: 0.2 (0.8) Total visits: 15.4 (7.4)	Inpatient visits: 4.3 (4.6) Outpatient visits: 8.4 (5.6) Home health visits: 1.5 (1.5) Other: 0.2 (1.0) Total visits: 14.4 (7.1)	Inpatient visits: 4.7 (4.5) Outpatient visits: 8.3 (4.9) Home health visits: 1.6 (1.5) Other: 0.2 (0.9) Total visits: 14.8 (7.1)

*Physiotherapist I: Staff physical therapist

**Physiotherapist II: Staff physical therapist with supervisory duties

***Standard per sopier: Providing patient care in both inpatient and outpatient environments

Each item was analyzed for significant differences between the two assessments, baseline and graduating scores, utilizing the Wilcoxon matched pairs test and McNemar's test. To perform the McNemar's test, the 'not applicable' score was removed from the data set to create a dichotomous outcome variable. The significance level was determined a priori to be 0.05. With the Bonferroni correction, the significance level was adjusted to 0.001. This information is provided in Appendix D.

Considering both the Wilcoxon matched pairs and the McNemar's test, participants demonstrated a significant improvement on the live patient examination from baseline to graduation on 18 of the items on the PDE. These 18 skills were in categories of evaluation, diagnosis, and prognosis. Of the 17 skills assessed in the category of evaluation, ten skills demonstrated a statistically significant positive change. One item, related to selecting a generalized intervention approach, demonstrated a level approaching significance at 0.002. The two items in diagnosis demonstrated a statistically significant change. In the category of prognosis, five of the six skills demonstrated a statistically significant change. The remaining skill in the category of prognosis (Predict the optimal level of function the patient will achieve) demonstrated a statistical significance of 0.002. One item in the category of intervention, joint mobilization, demonstrated a statistically significant change. Two additional items, exercises for mobility and soft tissue mobilization, approached significance at 0.002. Tables 4.2, 4.3 and 4.4 present the frequency of satisfactory scores as well as, the mean, mode, and median scores of the items in the categories of evaluation, diagnosis, and prognosis.

Table 4.2. Mean, mode, and median scores in the category of evaluation

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS					
EVALUATION					
	Freq. Satisfactory scores prior to residency education	Mode, median and Q1, Q3, IQR prior to residency education	Freq. Satisfactory scores following residency education	Mode, median and Q1, Q3, IQR following residency education	Sig. Wilcoxon/McNemar
(30) Identifying relevant, consistent, and accurate data	0/ 0%	1/1.00/ -	13/ 92.9%	2/2.0 /0	*0.001/ 0.001
(31) Prioritize reported functional limitations and activity restrictions (Resident must identify most significant/ primary functional restriction and at least one other)	0/ 0%	1/1.00/ -	14/ 100%	2/2.0 /0	*0.000/ 0.000
(32) Assess the patient's needs, motivations, and goals (e.g., assessing the patient's perspective related to his/her activity limitations or disablement)	9/ 64.3%	2/2.00/ -	14/ 100%	2/2.0 /0	0.020/ 0.063
(33) Develop working diagnosis (hypothesis) for <i>possible contraindications for physical therapy intervention when applicable to the patient.</i>	1/ 7.1%	1/1.00/ -	4/ 28.6%	2/2.0 /0	-
(34) Identify the <i>type/nature</i> of the patient's symptoms	14/ 100%	1/1.00/ -	13/ 92.9%	2/2.0 0/-	*0.001/ 0.001
(35) Develop working diagnosis (hypothesis) for the <i>stage of condition</i> (e.g. acute, subacute, settled, recurring or chronic)	0/ 0%	2/2.00/ -	13/ 92.9%	2/2.0 /0	*0.000/ 0.000
(36) Develop working diagnosis (hypothesis) for the <i>anatomical structures</i> involved with the complaint(s)	5/ 35.7%	1/1.00/ -	14/ 100%	2/2.0 0/-	0.003/ .004
(37) Develop working diagnosis (hypothesis) for the <i>probable cause(s)</i> of the complaint(s) (Nature: primary forces leading to the condition e.g., shear, compression, tension, neurological, cognitive)	0/ 0%	1/1.00/ -	11/ 78.6%	2/2.0 /0	*0.001/ 0.001
(38) Select tests and measures that are <i>consistent with the history</i> for verifying or refuting the working diagnosis	2/ 14.3%	1/1.00/ -	13/ 92.9%	2/2.0 /0	*0.001/ 0.001
(39) Assess movement coordination	2/ 14.3%	1/1.00/ -	14/ 100%	2/2.0 /-	*0.000/ 0.000
(40) Interpret data from the history and physical examination – related to the <i>irritability of the condition(s)</i> (<i>High, moderate or low irritability</i>)	0/ 0%	1/1.00/ -	13/ 92.9%	2/2.0 /0	*0.000/ 0.000
(41) Interpret data from the examination – related to <i>psychosocial factors</i>	-	-	-	-	-
(42) Decides when clinical findings warrant additional diagnostic testing or medical intervention prior to or in conjunction with physical therapy intervention	0/ 0%	1/1.00/ -	12/ 85.7%	2/2.0 /-	*0.000/ 0.000

(43) Select <u>generalized</u> intervention approach, as appropriate, to include physical therapy intervention <i>ie manual therapy, patient education etc.</i>	1/ 7.1%	1/1.00/ -	11/ 78.6%	2/2.0 /0	0.002/ 0.002
(44) Select intervention approach, as appropriate, to include <i>further examination</i>	0/ 0%	1/1.00/ -	12/ 85.7%	2/2.0 /0	*0.001/ 0.001
(45) Respond to emerging data from examinations and interventions by <i>modifying</i> the <u>current</u> intervention if applicable	7/ 50.0%	1/1.00/ -	4/ 28.6%	2/2.0 /1.8, 2.0,1	0.157/ 0.500
(46) Respond to emerging data from examinations and interventions by <i>redirecting</i> the intervention	1/ 7.1%	1/1.00/ 0	4/ 28.6%	2/2.0 /1.5,2. 0,1	0.083/ 0.250

Items that are constant have been omitted from percent frequency and IQR. Q1 and Q3 provided when IQR ≥ 1

Table 4.3. Mean and Median scores in the category of diagnosis

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS					
DIAGNOSIS					
	Freq. Satisfactory scores prior to residency education	Mode, median and IQR prior to residency education	Freq. Satisfactory scores following residency education	Mode, median and IQR following residency education	Sig Wilcoxon/McNemar
(47) Based on the evaluation, organize data into recognized clusters, syndromes, or categories	3/ 21.4%	1/1.00/ 0	14/ 100%	2/2.00/ -	*0.001 /0.001
(48) Based on the <i>diagnosis</i> , report the <i>most appropriate</i> (primary) intervention	2/ 14.3%	1/1.00/ 0	14/ 100%	2/2.00/ -	*0.001 /0.000

Items that are constant have been omitted from IQR

Table 4.4. Mean and Median scores in the category of prognosis

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS					
PROGNOSIS					
	Freq. Satisfactory scores prior to residency education	Mode, median and IQR prior to residency education	Freq. Satisfactory scores following residency education	Mode, median and IQR following residency education	Sig. Wilcoxon/McNemar
(49) Choose re-assessment measures to determine <i>initial</i> responses to intervention	0/ 0%	1/1.0/ -	13/ 92.9%	2/2.0/ 0	*0.001/ 0.000
(50) Choose re-assessment measures to determine <i>long-term</i> responses to intervention	0/ 0%	1/1.0/ -	13/ 92.9%	2/2.0/ 0	*0.001/ 0.000
(51) Establish plan of care, <i>selecting</i> specific interventions based on impairment	1/ 7.1%	1/1.0/ 0	14/ 100%	2/2.0/-	*0.000/ 0.000
(52) Establish plan of care, <i>prioritizing</i> specific interventions based on impairments	0/ 0%	1/1.00 /-	14/ 100%	2/2.0/-	*0.000/ 0.000
(53) Predict the <i>optimal level</i> of function that the patient will achieve	3/ 21.4%	1/1.00 /0	13/ 92.9%	2/2.0/ 0	0.002/0 .002
(54) Predict the <i>amount of time</i> needed to reach the optimal level of function	0/ 0%	1/1.00 /-	11/ 78.6%	2/2.0/ 0	*0.001/ 0.001

Items that are constant have been omitted from IQR

Forty items on the PDE did not demonstrate a statistically significant change in scores. Three of these clinical skills, related to the interview of the patient, demonstrated satisfactory performance at entry to the program. These three items included; communication with the patient, building rapport, and localizing the area of symptoms.

The additional 37 items on the PDE demonstrated a positive change in the mode, however, the median change in scores were not statistically significant. The criterion for scoring an item with satisfactory performance on the PDE does not allow for partial scoring and may have limited the ability to note improvement. For

example, if the resident recognized the need to perform a special test to confirm a diagnosis, but performed the test incorrectly, the score for that item would be unsatisfactory performance. One item on the PDE, assessment of the vertebral artery, remained not applicable at entry and at completion of the program for the majority of residents based on the patient presentation.

Resident scores for each category were also determined. The category scores for each resident at baseline and graduation were then compared. The significance level was determined a priori at 0.05. With the Bonferroni correction, the significance level was adjusted to 0.01. The change in score for each category was assessed using the Wilcoxon signed rank test and McNemar's test. To perform the McNemar's test, the 'not applicable' score was removed from the data set to create a dichotomous outcome variable. Table 4.5 demonstrates the statistical significance of the change in scores by category. The categories of examination and diagnosis demonstrated a statistically significant change. The category of prognosis approached significance at 0.015. The category of evaluation did not demonstrate a statistically significant change.

Table 4.5. Entry and Graduation Change in Scores by Category

Live Patient Examination	Freq. Satisfactory scores prior to residency education	Score prior to residency education Mode, median and Q1, Q2, IQR	Freq. Satisfactory scores following residency education	Score following residency education Mode, median and Q1, Q2, IQR	Sig. Wilcoxon and McNemar
Examination	131/ 32.3%	31.0/34.0 / 31.8, 40.3, 8.5	246/ 60.6%	33.0/36.5 / 33.8, 42.5,8.7	*0.001/0.001
Evaluation	28/ 12.5%	24.0/21.0 / 19.0, 24.5, 5.5	156/ 69.6%	21.0/24.0 / 21.5, 27.0,5.5	0.207/0.207
Prognosis	4/ 4.8%	10.0/10.0 / 9.7, 11.2, 1.5	78/ 92.9%	12.0/12.0 / 11.0, 12.0, 1.0	0.015/0.015
Diagnosis	5/ 17.9%	2.0/2.0/ 2.0, 3.3, 1.3	28/ 100%	4.0/4.0/-	*0.002/0.002
Intervention	9/ 6.4%	14.0/14.5 /14.0, 20.0,6.0	90/ 64.3%	14.0/17.0 /13.0, 17.0, 4.0	0.219/0.219

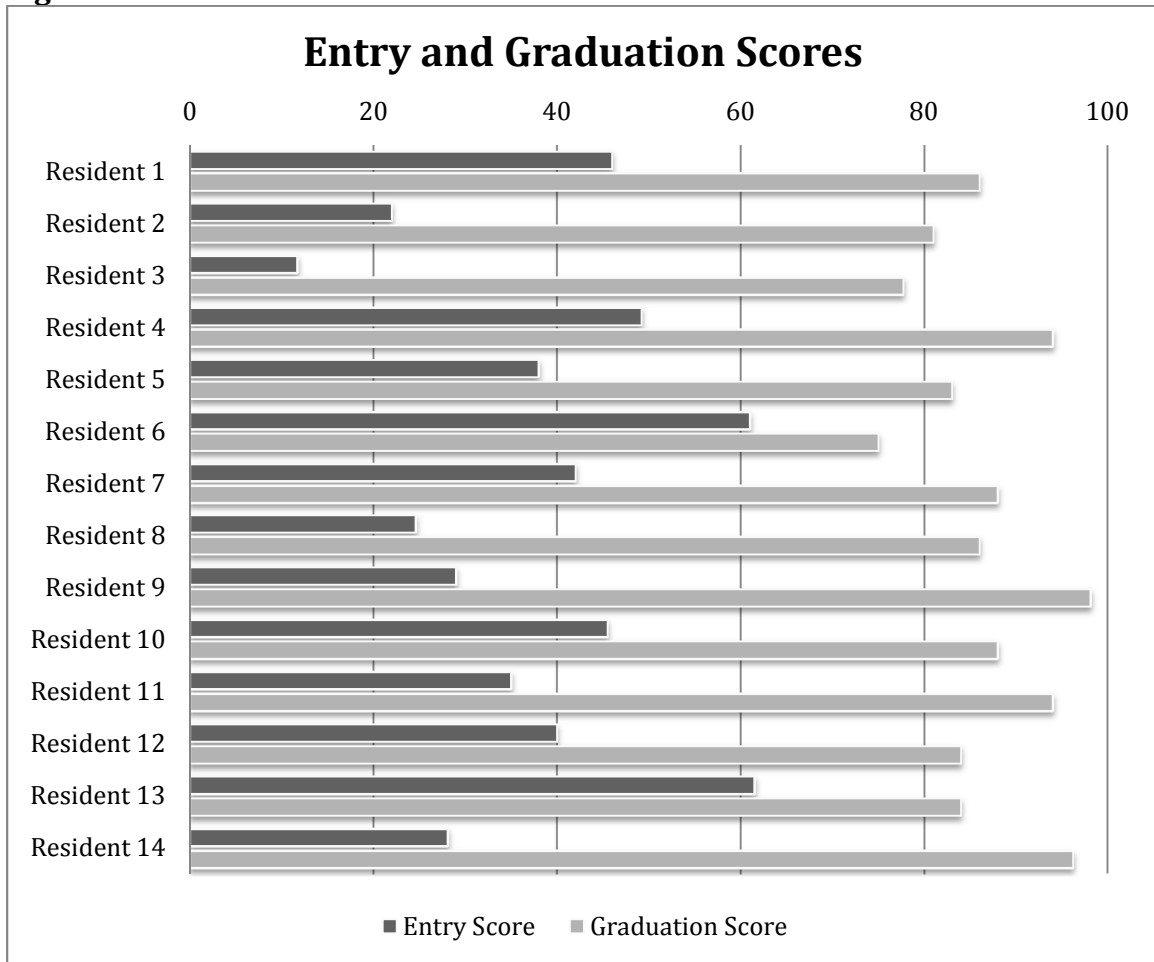
Items that are constant have been omitted from IQR

In addition, the pass rate improved overall from 0% to 100%. Scores on the baseline examination ranged from 11.7% to 61.5%. Scores on the graduation examination ranged from 75% to 98.1%. Figure 4.1 provides a visual representation of the change in the scores on the PDE from baseline to graduation for each subject. The two residents that had received previous mentoring, residents five and thirteen, demonstrated the highest scores on the baseline examination at 61.5%. The same two residents demonstrated the least percent change in scores. In order to compare overall examination scores for the group at baseline and graduation, a Wilcoxon Matched Pairs was performed, demonstrating a significant change in performance ($p < 0.001$).

Summary

Of the 64 items on the PDE, 58 items were assessed for change in score from baseline to graduation. The residents demonstrated a significant improvement on the PDE in two of the five categories of patient assessment suggesting an improvement in their ability to utilize clinical reasoning in the examination and diagnosis of a patient. Although the category of evaluation did not demonstrate a statistically significant change from entry to graduation from the program, residents demonstrated a statistically significant improvement in 10 of the 16 items in this category.

Figure 4.1.



Non- experimental Results: Professional Development and Career

Advancement Survey

Graduating residents (third and fourth residency cohorts) completed a survey adapted from a previously published survey on professional development career advancement performed with orthopaedic residents in the US.⁵ The residents completed the survey following successful completion of the final live patient practical examination. The professional development and career advancement survey can be found in Appendix E.

Research Question

How does participation in and completion of an 18-month orthopaedic manual therapy residency program influence the professional development and career advancement of the graduates of the residency program in Kenya as surveyed upon completion of the residency program?

Findings

Twenty-six residents completed the survey, with one resident choosing not to complete the survey questions regarding career advancement. Cronbach's alpha was performed for the 12 questions related to professional development, as well as for the seven questions related to the influence of the residency program on career advancement.

To determine the value and influence of the residency on professional development and career advancement, median values were determined for each of

the survey questions. The median values and percent of residents responding to the upper and lower range of the values are presented in tables 4.6 (professional development) and 4.7 (career advancement).

Summary

The majority of residents responded with an extremely positive or somewhat positive response regarding the influence to each of the survey questions.

Residency graduates in Kenya reported a positive impact of residency education on the ability to perform a comprehensive evaluation, utilize clinical reasoning in treatment decisions, and implement an effective treatment plan employing scientific literature. However, 45.5% of residents reported no influence of the residency on salary and promotion in the workplace.

Table 4.6. Graduate Residents' Professional Development (n=27)

Question: How has participation in the residency program influenced your....	Mean	Median	Min/Percent	Max/Percent
Ability to perform a thorough clinical examination	1.07	1.00	1 (92.9%)	2 (7.1%)
Ability to use a logical clinical reasoning process	1.07	1.00	1 (92.9%)	2 (7.1%)
Ability to provide an effective treatment to achieve projected outcomes	1.11	1.00	1 (89.3%)	2(10.7%)
Ability to treat in a time efficient manner to achieve projected outcomes	1.25	1.00	1 (75.0%)	2 (25.0%)
Ability to determine the nature of the patient's problem	1.11	1.00	1 (89.3%)	2 (10.7%)
Ability to treat complex patients	1.32	1.00	1 (67.9%)	2 (32.1%)
Ability to communicate with patients (clarity, organization, confidence)	1.04	1.00	1 (96.4%)	2 (3.6%)
Ability to communicate with other health professionals (clarity, organization, confidence)	1.00	1.00	1 (100%)	1 (100%)
Ability to perform overall patient management (assess potential benefit form physiotherapy, treatment and discharge planning)	1.43	1.00	1 (89.3%)	2 (10.7%)
Number of patient referrals to you	1.32	1.00	1 (67.9%)	2 (32.1%)
Number of professionals who refer patients for care to you	1.21	1.00	1 (78.6%)	2 (21.4%)
Ability to use scientific literature to provide rationale for interventions	1.14	1.00	1 (85.7%)	2 (14.3%)

Level of effect: 1 Extremely positive, 2 Somewhat positive, 3 No effect, 4 Somewhat negative, 5 Extremely negative, 6 Unable to assess

Table 4.7. Graduate Residents' Career Advancement (n=26)

Question: How has participation in the residency program affected your....	Mean	Median	Min/Percent	Max/Percent
Salary	2.23	2.00	1 (22.7%)	3 (45.5%)
Promotion in the workplace	2.28	2.00	1 (27.3%)	3 (45.5%)
Access to new job opportunities	1.41	1.00	1 (68.2%)	3 (9.1%)
Participation in Leadership roles (work in special clinics or special committees)	1.23	1.00	1 (81.8%)	3 (4.5%)
Career interest and fulfillment	1.05	1.00	1 (95.5%)	2 (4.5%)
Ability to critically read and evaluate scientific literature	1.09	1.00	1 (90.9%)	2 (9.1%)
Ability to obtain attain research opportunities	1.64	1.00	1 (60.7%)	6 (4.5%)

Level of effect: 1 Extremely positive, 2 Somewhat positive, 3 No effect, 4 Somewhat negative, 5 Extremely negative, 6 Unable to assess

Qualitative Results: Participants' Perceptions of the Residency Program

A qualitative research design was used to explore perceptions of the participants regarding their experience in the residency program. The following four research questions were explored:

RQ 1. What was the clinical reasoning process described by the participants during the live patient examination?

RQ 2. What new skills were fostered by the residency program for use in the clinical environment as perceived by the participants?

RQ 3. What barriers to participation did participants perceive they encountered as they progressed through the residency program?

RQ 4. What barriers did participants encounter when attempting to integrate concepts and skills gained during the residency program into their clinical practice?

Themes

Data collected during the one on one interviews, was analyzed by the primary researcher, with four themes emerging: (1) holistic, integrative clinical reasoning process, (2) knowledge and clinical reasoning skills gained and applied through clinical practice, (3) challenges recognized and reliance on support systems, (4) wider perspective and greater understanding of the profession achieved.

Theme 1: Holistic, integrative clinical reasoning

Residents discussed using the hypothetical-deductive reasoning process and narrative reasoning process throughout the examination of the patient, and in some instances, they integrated the both processes to develop a PT diagnosis. The residents noted the intimate relationship between the objective examination and the patient's perspective regarding the impact of the complaint on functional activities. Cue acquisition and developing a shared meaning of the impairment were described as equally important when determining a hypothetical diagnosis for the patient. Furthermore, residents considered the patient as a whole when determining the need for referral to other healthcare providers.

Residents discussed the need to perform a thorough individualized examination and the utilization of key findings to form a hypothetical diagnosis. The acquisition of cues from the patient's narrative and examination to develop and

reexamine the hypothetical diagnosis followed the four steps outlined in the hypothetical- deductive reasoning process; cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation.¹⁹

J.O. made a connection between the examination findings and the development of an individualized treatment plan, “So I do the objective examination, come up with an idea what I am treating, then I’m able to rule out issues and rule in others. After that I can make the treatment plan and execute the treatment and retest.” The focus on utilization of findings from the examination to guide the treatment plan was further expanded upon by W.S., “You develop treatment plans from assessment and it has to be a comprehensive assessment, like that whereby you go from [sic], you leave no stone unturned until you get a hypothesis. You treat that and reassess it and examine it again.” J.N. also described the hypothetical- deductive reasoning process in explaining:

Clinical reasoning, these are the thoughts you come up with after fully assessing your patient. So you have to collect everything from your physical assessment of the objective examination and reason out. Clinical reasoning is what will make you come up with good intervention of the patient.

H.M., explained the process as:

Clinical reasoning, for me, it means how one can process information that you get from a patient. Take that information, narrow it down and really get to what is happening to this patient, rather than just having an overview.

In addition, residents discussed the need to relate symptoms observed in patient presentations to determine a treatment strategy. This was explained by D.M.

Sometimes when you get patients, they like have combination of symptoms [sic]. You get a patient with back pain, patient with knee pain, patient with ankle problem, shoulder. So it becomes complex. Sometimes that's a challenge. You take each condition itself and you first begin taking good history and a good assessment. Slowly, slowly because you find these things, sometimes they are coordinated, sometimes they are different cases.

Residents also discussed the development of non-patient identified problems (NPIPs) as described in the HOAC II algorithm developed by Rothstein, Echternach, and Riddle.²⁸ Rather than focusing on the local area of symptoms in isolation, residents considered the underlying cause or contributing factors for the development of the symptoms. D.M., explained,

Now you need [sic] start think what structures are there that could cause pain. You don't just go to the back and assess it. You connect. It could be from the ankle joint, from the hip problem, could be from the muscular stuff.

This process in assessing the patient was described by T.D. as;

Reasoning out now it could be a pain [sic]. What kind of pain is it? Is it a just muscular pain? Is it from therapy? Is it a radiculopathy? And also that you understand, you have to know, thoroughly know, what is the problem. Not just the pain, but know where the pain is coming from. The structures that causes that pain.

M.D. discussed the need to look for symptoms related to compensations for the primary condition,

Most problems (are) not caused by one thing. Normally the body compensates and if a structure is not working the way it should, it can affect other structures. So I cannot restrict myself on one structure.

In addition to using objective measurements to support the patient's physical therapy diagnosis, residents expressed the importance of listening to the patient's story to develop a shared meaning for the patient's symptoms. These descriptions support the integration of the narrative reasoning process in the evaluation of patients. S.K.S., explained this as:

My reasoning has changed in terms of how I listen to the patient tell me her story. Because I listen, I'm trying to come up with either a hypothesis or the nature what [sic] this is, or time and pattern of the patient's pain. So it helped me be able to listen better and include a number of things the patient tells me, so that I'm able to involve the patient also.

M.D. concurred in noting the importance of listening to the patient's story.

Clinical reasoning simply means how you integrate what the patient is telling you. Because you have to listen to the patient. Whatever he or she is saying, what he's saying will lead you to what to do.

Another resident, W.W., stated, "Yeah, you get to appreciate different kind of diagnosis just by using all the patient's telling you."

Residents described gaining a wider perspective by synthesizing objective data with the patient's story. Some residents described a combination of sources to determine a hypothetical diagnosis for the patient, integrating two clinical reasoning processes: hypothetical-deductive reasoning and narrative reasoning. It

was through this integration of objective data and the patient's subjective comments that led many of the residents to the discovery of the underlying condition as expressed by one resident, J.N., who explained: "One it was from the patient's mouth, the description of the problem that she had. It gave me a clue of this should be this, but still I have to assess and find out if it is really the structure that is troubling here." This integration of processes was supported by S.K.S who explained:

Clinical reasoning means you have a patient, for instance, and you listen carefully to what your patient tells you. So that at the end of what your patient has told you and what you have examined and also what you have assessed and examined and find out [sic]. Then you are able to make a hypothesis and you are able to come up with uh an idea of the cause of the patient's problem.

AA also described how the integration of the patient's perspective supported the assessment process and conclusions drawn.

Okay, first of all, the patient will tell me his problems. Patients identify problems. When the patients tell me the problem, I will now assess the patient. Come with my list of problems and then those things I know where to assess [sic] and when I do my assessment, I get my hypothesis. I will know the diagnosis and I will know what to treat.

H.M. also explained the integration of clinical reasoning processes.

It's changed the perspective. I can sit with a patient. Get the patient to tell me what's happening. I slow down the process and now can feel this is what's wrong with this patient compared to how we do it before.

In addition to the development of a hypothetical physical therapy diagnosis, screening for non-musculoskeletal pathology and making timely referrals was highlighted as a key component of the examination. Residents discussed the need to examine the patient as a whole versus the area of somatic symptoms in isolation. They noted the need to recognize both medical and psychological issues present and considered this as a component of the clinical reasoning process. The determination of appropriateness of the patient for physical therapy was performed throughout the assessment. As explained by D.M. whether to refer or not is grounded in the reasoning process during the re-assessment.

It's something you need to refer because sometimes you get red flags. So you need to refer to the surgeon. Because sometimes you get a red flag, you go ahead with something, maybe you can get a problem and make it worse. Yea, so every day the patient comes to reassess [sic], we get her testing. So you do [sic], if the patient is getting worse, you need to think again why.

The importance of recognizing red flag symptoms was reinforced by R.M., "And the process come to understand [sic] where the problem is and in the process you are able to figure out any red flag serious illness that may not be a problem for physical therapy." In addition to red flags, J.N. discussed yellow flags for psychosocial influences on the patient's symptoms.

Through clinical reasoning you are able to determine whether a patient is appropriate for physical therapy. We are able now to tell the red flags or the yellow flags. These kind of things, the psychosocial need.

J.N. also discussed the importance of making a medical referral in a time efficient manner when a non-musculoskeletal cause of symptoms is suspected.

We are also able to identify patients with red flags and even refer accordingly. So it's taken uh lesser [sic] time uh then what I used to take with the patient before. Before it would take so long to identify their problem and actually we used to keep on referring them to the doctor. Now we are able to identify the problems and advise the doctor accordingly.

Theme 2: Knowledge and clinical reasoning skills gained and applied to clinical practice

Residents described contextual variables that at times, made it difficult to integrate skills gained through the residency program into clinical practice. They described a need to include modalities within the treatment plan to meet the patients' expectations for physical therapy. Education of colleagues was necessary for the residents to successfully implement new skills. Productivity demands also made it difficult for the residents to apply skills in the clinic. In contrast, the residency program facilitated integration of skills in the clinic by providing instruction that was immediately applicable to the clinic. As the residents were able to apply the knowledge, their confidence in patient assessment improved.

Subthemes include inclusion of patient preferences, education of colleagues, productivity expectations, and increased confidence gained by applying knowledge in the clinic.

Inclusion of patient preferences

Residents described how they were motivated to apply newly acquired knowledge and skills. However, there was resistance from some patients to try new interventions. Residents noted they needed to educate patients regarding manual treatment options and alternatives to modalities for patients to be open to the new techniques. J.O. explained, “Challenges are there especially when it comes to the patients. It was the patients who are used to, you know, hot packs, ultrasound and all that. Now you are coming to do something else.”

T.D. also noted some patients are not ready to accept the new treatment techniques, explaining:

Okay, the problem. Because like if you get those patients who are used to this hot pack and want me to use this. I want to use manual therapy. So some of them are not really ready to cooperate. They will do everything. They will still say, ‘I want hot pack.’

Residents discussed the need to change their treatment approach to assist the patients in accepting the resident’s new skills. C.E. noted she focused on flexibility and compromise needed to gain the patient’s acceptance of manual treatment as well as the modalities that patients expected, “Sometimes my patients could always want to see like [sic] at least a machine has to be used, but then I struggle to make sure I do manual therapy. Then give the machine to those that like them [sic].”

Residents also discussed how the utilization of modalities for the treatment of symptoms is often embedded in the clinic culture making the introduction of alternate techniques difficult. J.N. described practice before the residency as routine.

Initially, it was back pain. You use hot pack.... You are rushing after pain, but not after the patient's activities that he or she is unable to do. Just put the patient on a modality and that's all of it. They come back for the other [sic] visit, you don't even, and you don't even need to test. There was not retesting [sic]. Yea, they come back to just, to just routine, but now the practice has changed.

Education of colleagues

C.E. noted that colleagues also had difficulty accepting the new treatment approach, "I work in a clinic which had somebody who has not done the residency. Quite a number like using machines... So anytime I use my manual therapy minus using a machine I always get a position." W.S. mentioned that the utilization of new techniques could be intimidating to therapists unfamiliar with the training, "There are challenges because there are those people who have not done this and they think no, no, no we cannot, we cannot refer this patient because you, you are smarter than us. Yea, there are people feel they don't want to be, to be, I wouldn't say defeated but they don't want to be outsmarted by someone else."

In addition to changing their specific approach to treatment planning, the residents discussed promoting a new approach to patient care by providing formal instruction and education to their colleagues as well as serving as a consultant to

their peers for difficult patients. This transference of knowledge provided colleagues with additional techniques for treatment. Many of the residents are clinical instructors for physical therapy students. Residents that act as clinical instructors for students also reported exposing students to knowledge gained through the program.

A.A. reported the opportunity to provide instruction to colleagues after each onsite module.

In our clinic, we have days where we do Continuous Medical Education. So during the hours that we're given to do [sic], I come out there. I teach them what I learned from here and they are positive. They are happy.

C.M. reported formalizing training provided to colleagues through the development of a new position, "After I had my results, like how my patients responded every time, everybody was like what do you do different? So now that led to me becoming a training director in my clinic." Students also benefited from the education. One resident that serves as a clinical instructor, S.K.S. commented,

I worked in a hospital, a national hospital, which is also a teaching hospital. So we didn't having anything new to show the students. So right now, after the residency, there is so much knowledge to show our students and even so much knowledge to show our other colleagues what we learned in the program and also a lot of, a lot of good knowledge to give back to the patient in terms of patient care.

In addition to providing education to physical therapists, many residents reported providing information to other members of the healthcare team. As the

residents provided the advanced training, they gained respect from members of the healthcare team. O.M.O. explained his role in teaching others.

First I was given the opportunity to teach the other medics and other professionals, like the Continuous Medical Education. I could tell them what the difference [sic] between the normal general physical therapy that they know and the OMT and the different approaches. And from that, they could see the outcome and they respect me more.

Education provided to other disciplines improved patient outcomes beyond the rehabilitation needs of the immediate physical therapy community as explained by J.N.

Does it really change? I was talking to my colleagues, not only physios but doctors, and I was telling them what I learned in clinical reasoning; the ICF, the manual skills, everything. How everything is good. It is increased [sic], not only when in physio condition but in general health care conditions. You find that in most conditions, you often have to involve everyone.”

Residents that were not providing formal continuing education reported performing consultations for difficult patients. D.M. noted,

Then when you go to clinic [sic], you find that your friends and doctors would say, ‘I want you to see my patient.’ Because he knows, after he touches my patient, it is not the same as my colleague touching the patient... Now colleagues come to you and ask what do you do and you tell them this (is) what I do and I got this knowledge here.

W.S. further reported providing education through consultation, “I’m actually being consulted with what I am about, [sic] any condition about orthopaedics and physiotherapy. Because it gets hard to them [sic], they refer to me. Call me and tell me, we are stuck here. How do you go about this?” This was supported by J.M who explains,

In fact, even those who have not done the program, they always come to just tell them what to do. Because we share knowledge. Sometimes they never done [sic], but just tell them what to do. They try also and it worked for them. So that’s why they keep on coming.

Productivity Expectations: Challenged by high numbers

Residents also noted productivity as a barrier for employing the skills gained through the residency within their respective clinical practice. The residents often noted the number of patients needing treatment limited the ability to practice all assessment skills learned in the residency program. As explained by S.K.S.;

Most of the time we are challenged by the numbers. Although I see between ten and sixteen, I also have other duties to do in the process. So that makes it even more challenging to have adequate time with the patient to do that [sic] examination. So that’s quite a challenge, the numbers. Because at the end of the day, (the clinic) where I work, we see between eighty to a hundred patients. Yeah, so that is the challenge of a thorough examination.

K.O. also mentioned the difficulty in maintaining the current standard of productivity in the clinic.

Sometimes in the clinic you're under pressure because you have maybe several patients waiting. So you may not be as thorough and especially maybe [sic] there is a patient who just walked in, probably was not in your appointment for the day. So it can make you rush a bit.

D.M. noted strategies to deal with the limitations.

So when a patient comes the first time, you don't have all the time to do everything. So you have to go to the specific ones. For these ones you can do standing, walking, everything [sic]. Now in the clinic, the first day the patient comes in, you do the basics. The patient comes in you do mobility flexion, extension, your examination, you got the pain radiating, then I go palpation of the muscles to fix that one [sic]. Now when she comes next, you do what you did not do, because you cannot waste time doing everything while patients are sitting outside.

This approach was echoed by, M.D., "Some things you do for the next, the next visit. You can't do everything all day. So you're like okay, this is what this is, the presentation. What can I do?"

Theme 3: Challenges recognized and reliance on support systems

Residents reported socio-economic and work commitments created barriers to participation in the residency. Residents were required to attend onsite modules in two week blocks, which resulted in 12 weeks of leave from work over the 18-month residency program. Female residents in particular, discussed the difficulty in maintaining employment, meeting family responsibilities, and participating in the residency program. They spoke about the effort to maintain a balance between

work, education, and family life. Residents that lived outside of Nairobi discussed the challenges of travel and additional costs of staying in Nairobi for two-week periods to complete the onsite modules. In addition, residents relayed that it was challenging to get frequent and extended time off from work to attend the onsite modules. The residency program was not recognized as higher education by administration, which made it difficult to justify the advanced training.

Residents also described what supported their participation in the residency program. The residents noted personal support networks that included family support, employer support, and residency mentor support. They also discussed specific facilitators within the residency program such as accessibility to resources and motivation and guidance provide by the residency administrator. Subthemes include: balancing responsibilities, limited recognition of newly gained qualifications, altruistic motivation, and support networks.

Balancing responsibilities: family, time, and finances

Residents with young children reported difficulty in managing family responsibilities and the time commitment of the residency program. One resident, A.A., stated, “Being a family person, it’s hard having your kids to juggle through school and the family. It’s hard, but I thank God I was able to get through.” Another resident with a young child, N.K., similarly noted, “I have a small baby. My baby is just growing and sometimes leaving my baby for two weeks, for two weeks, sometimes it’s hard.”

In addition to the time commitment required for the residency program and the time away from home for the onsite modules, the sacrifice to take time off from work was noted. S.M. explained,

You miss work on such day because they tell you no we are not going to pay you and maybe that money was in your budget. So this is some of the difficulties [sic]. Also paying, the paying [sic] back the thing that you lost at work; you have to work overtime, you miss your social life, your family life. So you pay back heavily to come to class.

D.M. stated, “The biggest barrier we encountered these schedule [sic] for work and class. It’s very difficult for your employer to understand that you need to come to class every cohort and you miss work on such day [sic].”

W.S. reported he almost lost his job in order to attend class,

It’s related to work, the time schedule to come to class and the time I need to be at workplace. I remember, I even risked my job. I almost got fired. Yeah, because I had taken an emergency leave for the residency.

An added financial burden was added for the several residents that lived outside of Nairobi and had to travel to the residency onsite modules. O.N. traveled a considerable way to Nairobi and described what it meant to him to do so.

There be [sic] challenges maybe with finances there[sic] and being somebody that works outside the capital city. I started when I was um at the border of Kenya and Somalia and Amiran. I would come. It’s over 1600 kilometers, so travel three days to be here.

Another resident that traveled a long distance to the residency stated, “If I work in a town that is not near me. I have to travel. I have to find accommodation in the city, which is expensive. Find food and transport. So all that makes your budget bigger for those two weeks that you are doing your residency program.” The extent of the challenge of traveling for the onsite modules was explained by E.O. “Distance, because I stayed somewhere far, somewhere far. So I always had to look somewhere to stay. Every module was far more difficult for me.”

Limited recognition of newly gained qualifications

An additional challenge was experienced by residents who described a lack of recognition from employers for participation in the residency program. Residents explained the residency program was not regarded as advanced education and therefore did not result in promotions in the workplace. S.K.S. noted the lack of a degree limited management’s perception of the residency as advanced education.

All I wish is that this course should have been done at a Master’s level.

Because it’s more than a higher diploma and too also wish [sic] that I don’t know that we can convince the hospital that the course that we’ve done is more and more [sic] education and training and that it needs recognition.

J.N. relayed a similar lack of by administrative recognition of the degree and its impact on the graduate residents.

...in terms of advancement in the job growth and salary, the hospital has not yet identified the content of this course as a major training, as a major professional training. So we are still negotiating with them. People that have

done this have not earned any complement. They are not being promoted and that in itself is um, it's demoralizing to the people, but we are encouraging them that we are going to work on[sic].

Altruistic motivation as a driving force

Residents found the information taught in the residency to be clinically applicable and the utilization of patients as models in class reinforced how to apply the new knowledge. The ability to apply the new skills in the clinic lead to improved patient outcomes. As patient outcomes improved, residents gained motivation to continue to improve their skills and knowledge. J.O. described the course curriculum.

It was practical teaching whereby you transfer the skills and how you look at it, from the point of knowledge [sic] and then transfer it to the skill.

Especially during the class time, where by you have real patients you study. More than just when you are using a model, you have the real patients in class and then you are able to see the teacher treat the patient and that helps you to know that it's very possible to handle such [sic].

H.M. similarly recognized the depth and breath of the curriculum:

The practical in class and when we would have patients, real patients now, not from the books, some a patient would be brought in and you go through the questions. Everything assessing this patient with our lecturers. So you would see this is what the patient is saying. So this is what it mean [sic] and maybe this is not what you're supposed to say with this patient. So that's what worked for me.

Residents also noted how the focus of the onsite modules was on application of the information and treatment of the patients. B.S. expressed this as a comparison to entry level education, “The narrate was good, understandable. Then, also, they use more practical, they less rigid [sic], so we had treatment more.”

Residents felt the program provided new perspective for patient care. S.M. explained, “Every moment that I was taught, every experience was a new experience because it’s a new, it’s a new course and a new approach to treatment here in Kenya. So for me, it’s a really fresh experience and really new.” K.O. initially felt he did not need additional education, “I told myself I have enough experience in the field out there. When it come to realize [sic] it’s something different all together.” This was supported by R.M. who commented, “I learned so many new techniques that I have never understood before. The new techniques and now I am with new technique [sic], especially with the current clinical practice I can do this that normally you cannot do.”

The residents also commented on increased confidence in providing patient care as they progressed through the residency program. They related this confidence to increased knowledge and manual therapy skills gained through the program. C.E. commented, “Actually the experience has made me, like I do not fear any of the condition or presentation of patients that has [sic] to my clinic. It has made me like, I am more brave, more able to assess any of the patients and able to treat any of the conditions in regards to musculoskeletal system.” E.O. noted how his confidence increased throughout the program, “At first I had challenges handling

different types of patients. But currently I have a lot of confidence when the patient approaches me and I do my assessment.”

This confidence aided communication with other medical providers. One resident, W.S., who traveled within Africa to provide PT, noted how increased knowledge allowed him to discuss patient care confidently with others.

I would travel with a Kenya team sometimes, athletics team, but there, I would say, you see other stuff physios do and you compare with what you do. You say wow, did I really do anything to help yourself [sic], but after doing this, I think I’m confident enough I can face anybody and I can discuss with my colleagues any condition whatever [sic] and tell them this condition is like this and this is like this. You can discuss and come into consensus about an issue, but initially you would not because you did not have the knowledge.

Reliance on support networks

The residents noted personal support networks, employer support, and facilitators within the residency program as factors that facilitated their participation in the residency program. Support included financial support, emotional support, accessibility of residency materials, and encouragement from mentors from the United States.

D.M. reported, “Family, they are good. When you say you have this financial problem, I am not able to do this module, they will say I will help you and they do that.” W.S., who traveled a long distance to Nairobi, mentioned support from a sister,

I got support from my family, very much. And family, including my sister, because I come like four hundred miles away. So when I'm in Nairobi for the residency, I get support from my sister for upkeep for the period of the module. Every other module, she would accommodate me and tell me, you're in Nairobi and you're in your residency modules, come spend it at my house. So I got, I got very big support [sic].

In addition to financial support, a resident with children, noted, "What really helped, my husband helped me a lot. Supported me with the kids."

In contrast to residents that perceived a lack of employer recognition of the advanced education, some residents received support from their employers that facilitated participation in the residency. Employer support was described as financial and flexible work assignments within practice areas. J.N. described how she "...got the financial support from the hospital I work. They paid for me. And I think to me, that was the best support you could ever get, allowing me to come."

In addition to financial support, residents noted the importance of having the opportunity to practice their newly acquired skills in outpatient settings during the residency training. S.K.S. explained,

Yes, the institution allowed us to practice immediately when we started the program. Like me for instance, I used to work in the inpatients, but I was brought to the outpatient where several patients with musculoskeletal issues come to. So I was able to daily practice [sic] what I learned from school.

J.N. also noted support from management as patient compliments increased, "The most important is the support from the management. The management actually

they are very supportive as a program about getting compliments from my clients and even now trying to engage all of the hospital management to also embrace OMT.”

Residents noted the organization and accessibility of resources made available by the residency program helped facilitate participation and completion of the residency. All information necessary for the online modules was downloaded to a Dropbox account. Residents could download or print the materials while on campus. This negated the need to purchase textbooks or access the internet from community facilities. The residents also noted they received encouragement from mentors from the United States and the onsite program administrator that provided impetus to continue in the program. The onsite administrator provided residents with a contact during and between modules, as well as coordination of modules. The maintenance of a consistent personal relationship was an important component for successful interaction between the residency instructors and the residency participants.

The residents noted access to course materials before the onsite modules allowed for pre-reading and increased preparation for class. K.O. explained how “...the material they send before in the Dropbox. That’s also been quite helpful.” The access, through Dropbox, also made materials for studying accessible. O.N., commented, “More so the information that is sent on Dropbox. It makes it much easier for you to just study from where you are and then when you come, you at least [sic] you’ve internalized something and you get to flow well with the teachings.”

The onsite administrator was crucial for ongoing communication and coordination of the modules. This was recognized as a strong support as noted by O.N.,

That the schedule has been kind of friendly with the arrangement of the leadership of the Mr. D. He was able to arrange well and then he communicates [sic] people in advance, so that makes it easier for you to plan yourselves to be able to attend. And then he has also been also good in terms of the payments for the school... So I think that's what assisted in terms of attending.

S.M. noted encouragement from the administrator to practice skills through access to labs on campus, "Mr. D, he's one of our facilitator, [sic] and he encourages us every day and he gives us even the practicing room to do our practice."

Residents also discussed support provided by the mentors and instructors from the United States, recognizing the value of their encouragement and enthusiasm towards teaching. E.O. explained, "The lecturers they come prepared. They personally, they really encouraged me and when I was ever in doubt they always came and told me that I just didn't think simple. So they really encouraged me." This sentiment was reinforced by K.O. who noted, "All the facilitators have been very good and they've also made us come this far, encouraged us, and if we had questions they were ready to answer any questions that we had when we did not understand, the reading." J.N. also noted support provided through the U.S. instructors, "Yea, well our lecturers were very, very supportive, very

knowledgeable. They were very eager to teach us and it's because of them that we're where we are today.

Theme 4: Wider perspective-greater understanding of the profession

The residents noted a change in perspective regarding the scope of physical therapy. The new approach to patient care was often compared to patient management performed prior to the residency training, which included limited assessment and focused on the use of modalities to treat the patient's symptoms. The wider perspective gained from an expanded clinical decision-making process resulted in a shift in practice from managing symptoms to assessing impairments. One resident with many years of experience, A.A., commented on the expanded scope of practice.

During my day, I would just ask the patient, 'Where is the pain' and the patient would tell me, the pain is here. You wouldn't ask if it's affected his functional, his function in the society. We just treat the pain, follow the pain. But not even test if it's a joint, if it's a muscle, if it's a ligament. We are just going for the pain. Yea, if you feel pain here, we just take a hot pack, ultrasound and some exercises.

J.N. concurred with the expansion in perspective, explaining:

Just put the patient on a modality and even exercise to do with [sic] and that's all of it. They come back the other visit [sic], you don't even, you don't even need to test, there was not retesting. Yea, the come back to just, to just routine, but now the practice has changed.

E.O. agreed about how his (her) clinical decision making process had changed

Okay, I used to get patients just coming to tell me I have neck pain and uh once it's localized or it has some neuron symptoms, we just do some massage. We don't even go into the routine. Okay, it's just pain. We don't go to the cause of it.

This expanded knowledge led to a change in perspective of what physical therapy can provide. One resident, H.M., explained, "You can see, even in my class, we have a difference in how we do physio before and how we do it now. So it's been a wonderful experience, changing our thought process."

Following the residency, residents describe how utilization of modalities as a protocol for the patients' symptoms was replaced by individualized treatments for the patient presentation. The residents noted the ability to perform an assessment of the patient and relate the findings to a treatment plan. This resulted in providing individualized treatment plans versus the use of a protocol. O.N., commented,

It changes how we would treat things. Like I said initially, two people may have the same problem in the shoulder, but presenting very differently. So you not have the same treatment plan for each and every other patient. You have learned to individualize each person, his or her problem. And then that helps me develop a treatment plan for patients individually.

M.D. reaffirmed the change in perspective,

The issue is go down and put a hot pack [sic], because I don't know what's happening. But now, I am able to tell how to treat this patient if it's a muscle. I am treating it because this has pain. I am treating it because there's

stiffness here. I am able now to know what I am doing. Not that I'm just doing it because the patient is here.

The development of clinical reasoning skills, through participation in the residency program, allowed the residents to consider underlying causes of the patient's symptoms. By considering more than the symptoms being presented, the residents now express the ability being to develop individualized treatment plans. This perception was expanded upon by H.M.

I slow down the process and now can feel this is what is wrong with this patient compared to how we do it before. Our patient would come tell me her [sic] back pain, so I would not check everything that may be what is causing this pain. I would just think it is a general pain like any other. So now, with the clinical reasoning, I can see this patient fitting this category. So this is where you need to see this patient from [sic] and help her from there.

The residents noted an evolution in their practice from the use of protocols, involving the use of modalities to treat a patient's symptoms, to the application of clinical reasoning to develop individualized treatment plans. It was this clinical reasoning development that allowed the residents to expand their professional role.

When describing their experience in the residency program, residents discussed not only individual and clinic changes related to patients but expressed how the program impacted changes within physical therapy as a profession. S.K.S. stated, "We've learned a lot and we do appreciate [sic] and it has changed the face of physiotherapy practice in Kenya for many of us." This was further described by M.D. who explained, "I just say thank you for the program because without this program,

then we would be nowhere. Many people still suffering without whoever [sic] can help them. But now since you are here in Kenya, we can do it, we can help.” J.N. further commented, “It has meant a lot in the evolution of physical therapy practice in the country.”

Each interview concluded with an opportunity for the residents to discuss any aspect of the residency program that had not been examined through the discussion. When the residents were asked if they had any additional comments related to the residency program, in addition to gratitude for the opportunity to advance their education, residents described a commitment to pursuing additional opportunities to further their education. J.M asked if any additional training would be brought to Kenya through the residency program, recognizing that the scope of practice involves more than orthopaedic therapy, noting “Anything that is offered, we will come for it. Because I know it involves everything. It involves so many things.” W.S. commented on the desire to continue his education, “Yea, it was an excellent training and I would want to further reach more. The soonest, I appreciate. I’ll do it. I promised myself, I’ll do it to further reach [sic].” This sentiment was also described by R.M. as he discussed the need to continue to update his knowledge, “It will also lead to continuous education. Yeah, so very important. For us to be updated and maybe in the future, maybe to form a sort of society. (A society) where by orthopaedic manual therapist can get to the current presentation and more seminars.”

The residents expanded the reach of the residency program by providing education to peers and colleagues within the wider healthcare system. This not only

resulted in the improvement of patient outcomes in physical therapy, but improved the healthcare teams understanding of the scope of physical therapy practice. As the residents continued to improve their knowledge, skills and clinical reasoning, their commitment to life-long learning was reinforced. Not only did the residents discuss continued formalized training, they indicated heightened interest in ongoing conference attendance.

Summary

The residents in the third cohort of the program demonstrated an improvement in clinical reasoning from initiation of the program to graduation. In addition to the improvement of scores on the PDE, residents discussed utilizing both hypothetical-deductive reasoning and narrative reasoning to develop a hypothetical diagnosis and treatment plan. The residents from the third and fourth cohorts reported professional development and career advancement through survey results. Positive survey results noting improved clinical reasoning, patient outcomes, communication with other health professionals, and career fulfillment were supported by one on one interviews conducted with the residents. Areas on the survey that did not improve included job promotion and salary. Qualitative interviews supported these findings and provided a potential reason for the limitation as a lack of acknowledgment of the residency program as advanced education.

In the one on one interviews, residents noted several barriers for participation in the residency program and to integration of the skills learned through the residency program into clinical practice. Barriers for participation in

the residency included managing family and work responsibilities and additional costs associated with travel for residents that lived outside the city of Nairobi. Barriers to integrating the skills in the clinic included the need to maintain productivity standards, patients resistance to new treatment techniques, and the clinic culture that limited the introduction of new skills and treatment approaches. Facilitators for participation in the residency program included support from family and employers, motivation to continue in the residency, and increased confidence in patient care. Facilitators related to the residency program included easy access to course materials, ongoing communication with the onsite residency administrator, and encouragement received from US mentors.

Additional benefits were seen by not only the residents' change in delivery of care, but also in their contribution to the profession of physical therapy. This was expressed as opportunities to provide education to others, both within the profession of physical therapy and outside, and to advance the practice of physical therapy. The residents described increased recognition of their role as physical therapists as members of the healthcare team. This recognition, in combination with improved patient outcomes, led to improved confidence and a desire to increase their contribution to the profession. The residents also noted a commitment to lifelong learning and the belief that the program is assisting with the progression of the practice of physical therapy and the profession as a whole within the country of Kenya.

Chapter 5: Discussion

Introduction

In this chapter, the results of this dissertation are presented in relation to current literature on the development of clinical reasoning and the influence of residency training on professional development and career advancement in physical therapists. In addition, the themes developed through the qualitative interviews will be examined. The implications of the findings (relevance to the profession) and recommendations for future research as well as the limitations and delimitations for the study are also discussed.

Clinical Reasoning Development

Residents in the third cohort of the orthopaedic residency program in Kenya demonstrated a significant improvement in knowledge and clinical reasoning as measured by performance on the PDE at entry into the program and at graduation. Statistically significant improvements were noted in two of the categories of the PDE; examination and diagnosis. There were 18 individual skills that demonstrated a significant improvement from baseline to graduation. The majority of these skills were in the categories of evaluation, diagnosis, and prognosis. Ten of the seventeen skills in the category of evaluation demonstrate a statistically significant change.

Residents demonstrated a significant improvement on both items in the category of diagnosis. This coincides with the hypothetical-deductive reasoning process in which hypothesis revision occurs throughout the patient encounter.²⁴ Residents demonstrated a significant improvement on five of the six items in the

category of prognosis. These items closely align with the HOAC II algorithm including choosing reassessment measures and selecting and prioritizing interventions based on the patients impairments.²⁸

Although a significant change was not noted on the individual skills within the category of examination, cue acquisition improved between baseline and graduation. On entering the program, residents collected an average of 36.1% of the available cues in the history and examination. At graduation, the residents assessed 81.3% of available cues. Similar to research performed by May et al, cue acquisition considered key for the diagnosis of the patient was incomplete for residents entering the program.²⁶ A lack of appropriate cue acquisition has been associated with novice practice. This suggests minimal connections were being made between the history and the physical examination.²⁶ Prior to participation in the residency program, the therapists' performance during the subjective examination was consistent with novice practice.

The category of evaluation focuses on the identification of relevant data, prioritization of limitations, development of a hypothetical diagnosis, screening for medical referral, and selecting the intervention approach. This is directly related to cue interpretation and hypothesis generation within the hypothetical-deductive reasoning model.²⁸ Residents demonstrated a significant improvement in ten of the seventeen items assessed in this subcategory.

Two of the items that did not demonstrate a significant change included: (1) responding to the emerging data from the examination and (2) performing adjustments to interventions when necessary. However, due to the high rate of the

items designated not applicable for the patient case during the examination performed at graduation (64.2%), it is difficult to accurately interpret the resident's performance. This aspect of the tool may be better tested when using the tool during mentoring sessions with residents. Reassessments of patients for ongoing care may provide a better opportunity to observe these skills in context. For example, the resident may need to alter the plan of care if the patient is not progressing towards the goals determined at the initial evaluation. The third item select an intervention approach, as appropriate, to include physical therapy intervention approached significance at 0.002.

Only one skill in the category of intervention demonstrated a statistically significant change between baseline and graduation assessments. That technique was joint mobilization. Two additional skills approached significance at 0.002, therapeutic exercise to improve mobility and soft tissue mobilization. Manual therapy was the emphasis of the program. Many of the other intervention skills were not integrated into the curriculum due to limited resources available for physical therapy treatment. However, the lack of patient education was unexpected.

Only 57.1% of graduating residents performed education regarding the physical therapy diagnoses with the patient. This may reflect an area of decreased emphasis in the curriculum or a decision made by the resident due to time constraints. In the qualitative interviews following the examination, nine residents noted if time allowed they would provide additional education to the patient

including information regarding the diagnosis. Utilizing the assessment tool in the clinic during mentoring sessions may provide a better representation of the resident's ability to provide education over the course of an ongoing treatment plan.

Based on the above findings, all graduating residents appeared to closely follow the hypothetical-deductive clinical reasoning theory. The graduates collected key information, including a thorough history and baseline objective measures. This information was used to determine special tests to be utilized to confirm or refute the hypothetical diagnosis. The hypothetical diagnosis guided a trial intervention. The findings in this current study are similar to Rivett and Higgs and May et al. who also found that both novice and expert physical therapists use a form of hypothetical deductive reasoning in their assessment of patients.^{25,26}

None of the residency graduates utilized an assessment style that would represent pattern recognition. Although this could be attributed to the nature of the examination and the residents' desire to demonstrate all skills taught within the residency, 13 of the 14 residents reported during the qualitative interviews that the examination was an adequate representation of clinical practice. Individual interviews, following the final practical examination, further explored the clinical reasoning process utilized by the residents during the patient encounter. The interviews with the residents supported the use of hypothetical-deductive reasoning. Residents discussed using the objective information gained through the examination to narrow down potential physical therapy diagnoses. They also discussed reassessing the patient though a trial treatment performed as a

component of the assessment. These descriptions are consistent with research performed by Payton and May et al. in which clinicians utilized the physical examination and history for hypothesis generation and evaluation.^{25,26}

In the interviews, some residents discussed the importance of listening to the patient and understanding their story. This desire to understand the patient's perception of illness closely follows Kleinman's model.⁵⁰ The Explanatory Model of Illness describes the importance of understanding the patient's perspective of the illness. The healthcare provider must understand the social and personal meaning that the patient attaches to illness.⁵⁰ Furthermore, to develop an effective plan of care, the healthcare provider must understand the patient's goals for treatment. This assists in creating a shared meaning of the illness and provides a basis to provide patient education regarding the treatment plan.⁵⁰ The incorporation of the patient's perspective allows for the validation of the patient's EM and marks the beginning of the formation of the treatment plan.⁵⁰ This is also a component of the narrative reasoning process.

The residents combined the biomedical model of determining a tissue or cause of the patient's symptoms with an understanding of the illness. This enabled the resident to value all of the patient's symptoms and not the tissue response to testing alone. The collaboration of the patient and practitioner EM results in effective clinical communication.

Residents also described the clinical reasoning processes of hypothetical-deductive reasoning and narrative reasoning being utilized interchangeably during the practical examination. In addition to tests and measures performed, the

residents described information gained through the patient history and the influence of this information on the development of the hypothetical diagnosis. During the interviews, the residents described the need to understand the patients' perception of the pathology and what they believed was the problem. This is similar to research performed by Edwards et al., which explored the clinical reasoning process utilized by physical therapists.¹⁹ Two clinical reasoning processes were described by Edwards et al. during the diagnosis of patients; diagnostic reasoning and narrative reasoning.¹⁹ Clinical reasoning moved between diagnostic reasoning using the hypothetical-deductive process and narrative reasoning to understand the patient's beliefs regarding their experience.¹⁹

The themes gathered in the qualitative interviews regarding clinical reasoning resembled physician perceptions of expert practice as described by Mylopoulos et al.⁵¹ In that grounded theory study, four interconnected themes were derived from interviews with 34 physicians at six North American research sites. The four themes included (1) extensive knowledge gained through clinical practice, (2) being able to effectively gather the patient's story, (3) integration of clinician knowledge and the patients narrative during formation of the diagnosis, and (4) continuous learning.⁵¹ Similar to the above themes, the residents in this current study discussed the importance of having a strong knowledge base and the reinforcement of this knowledge through patient care. In addition, the residents in the current study discussed the importance of listening to the patient and the integration of the clinical findings with the patient story to determine a diagnosis. The residents from the Kenya residency program also discussed continuous

learning through presenting difficult cases to the cohort and instructors to allow the challenging diagnosis to provide an opportunity for learning. These perceptions of expert practice appear similar across disciplines and countries.

Professional Development and Career Advancement

In regards to professional development, the residency graduates in Kenya noted a somewhat positive to extremely positive influence of the residency education on professional development, which is similar to residents surveyed in the United States.^{4,5} Graduates in the United States and Kenya reported a positive impact of residency education on the ability to perform a comprehensive evaluation, utilize clinical reasoning in treatment decisions, and implement an effective treatment plan employing scientific literature.⁴

The Kenyan residents differed from United States graduates in two areas; salary and job promotion. During the qualitative interviews, the residents indicated that the residency and associated advanced diploma were not recognized as a degree in Kenya. The program was therefore not generally associated with improvements in salary or job position provided by employers. This concurs with the current pay structure for public employees in Kenya announced by the Public Service Commission in 2014 stating that employees with diplomas could not advance above job group J.⁵² In order for the advanced education to result in career advancement under the current system, the program must be associated with a higher degree such as a bachelor's degree. The pay structure in Kenya is representative of flat organizations in the United States, where there is limited career advancement are reported in sales literature.⁵³

Furthermore, in collectivist cultures, education is a means to gain prestige in ones social group.³⁴ The degree is considered more important than acquiring competence. The lack of a formal degree beyond diploma limited not only the residents' ability to acquire an increase in salary, but also impacted their ability to join a higher social group.^{34,36}

Qualitative Findings

Although there were barriers to participation in the residency program and utilization of new skills in the clinic, the residents noted multiple facilitators through family, work and residency support systems. There is limited literature regarding the barriers and facilitators for participation in residency education and implementation of this education into clinical practice. The findings from this study add a unique description of the residency experience from these resident's perspectives. Facilitators for participation included personal support networks, employer support, motivation from improved patient outcomes, and the support provided through the residency itself. Barriers included travel to the residency site, balancing work and family responsibilities, and taking time off from work.

Support from the residency was discussed by residents in relation to program planning to facilitate the integration of online teaching materials developed from a low-context culture into successful education in a high-context culture. The United States is considered a low context culture and Kenya is considered a high context culture. Within a high-context culture, nonverbal communication is based on an awareness of cultural norms. In a high-context educational system, face-to-face encounters with the instructor are used to explain

course requirements and the written syllabus or handouts are often ignored.¹² In contrast, in a low-context culture, communication occurs explicitly.¹² Written instructions and educational materials contain significant detail and are used as the primary resource. Learners from high-context cultures may have difficulty in online coursework as communication styles differ and interaction is less personal.¹² Students from high-context cultures have also been shown to be less open to participating in online discussions.¹²

Due to the differences in culture (high-context and high uncertainty avoidance), students in Kenya may be more amenable to learn in an environment adapted to their learning preferences. The development of the residency to include integrated onsite learning modules allowed for the Kenyan residents to interact directly with instructors and mentors throughout the program. The residents noted the ability to clarify information provided in the online materials as they progressed through the program as a highly valuable facilitator. They also reported that the instructors were willing to continue to answer questions until the entire cohort understood the concepts being presented. This allowed for the instructor to give a variety of examples of concepts and decreased the uncertainty of the information being provided in the online materials.

In addition to teaching concepts, the instructors and mentors from the United States and the onsite administrator were considered powerful motivators as they encouraged the residents to continue their participation in the program. Collectivism is considered a component of high-context cultures where the community works together to learn skills and the success of the individual is

regarded as a success for the community.¹² The social network in which the high-context learner exists is extremely important as the learner navigates the online educational environment.⁵⁴ If the social network is absent, the learner may feel abandoned. Collectivist beliefs may have extended beyond the program itself as residents discussed the support networks that enabled them to be successful in the program, foremost family followed by employers.

The residency program used Dropbox to provide resources to residents. The Dropbox application provided a shared folder for students to access. The folder automatically synced each time the residents were connected to the Internet for onsite modules. This allowed the residents to access updated course materials and literature without having to download each file or having to become accustomed to an online learning management system. The access to materials online has been considered a barrier in high-context cultures due to learners having difficulty accessing resources.¹² However, the residents discussed this as a positive aspect of the program. The residents are instructed in how to download the Dropbox application onto an electronic device during residency orientation. Hofstede noted that the technology expectation in large power- distance cultures is easy familiarity with the learning portal and prescribed curriculums.³⁶ The Dropbox account was organized by module and included the APTA resources, current literature, and instructor handouts for each session.

This allowed the residents to access multiple resources without the need for purchasing expensive textbooks or paper for printing. In addition, the residents discussed downloading any additional information when in Nairobi for the onsite

modules. This allowed instructors and classmates to provide assistance if any difficulty occurred. The support for technical issues helped to defray potential concerns of the residents about limited experience with utilizing the Internet for resources.

In contrast to facilitating factors identified by the residents for participation in the residency, in particular, the female residents noted difficulty maintaining a work-life balance while participating in the residency program. Work-life imbalance is experienced when participation in one role makes it difficult to participate in the other. This results in work and life duties that are incompatible.⁵³ The concern over the ability to pursue higher education and to maintain time for family and friends has been reported a barrier in the nursing profession as well.⁵⁵ Morgenthaler noted lifestyle changes as a deterrent for nurses to pursue advanced degrees. This barrier has been noted not only in the United States, but in a study of woman engineers in Malaysia as well.⁵⁶ Miller noted that balancing family and work is the most significant barrier in women's' attempts to advance.⁵⁴

In contrast to research performed in the United States, regarding barriers to career advancement, the residents in this current study reported increases in overall job satisfaction as patient outcomes improved following residency education.⁵³ The improved job satisfaction was not related to increases in salary or job promotion. In the research by Briggs, Jaramillo, and Weeks, lack of career advancement through job promotions in companies in the United States resulted in decreased overall job satisfaction.⁵³ Similar limitations have been noted in nursing as well. Smith, Phillips and Turner reported nurses did not see the benefit of

obtaining an advanced degree because it did not equate to a change in their role in the workplace.⁵⁷ In contrast, when considering job satisfaction, the residents in Kenya were focused on improved patient outcomes and increased recognition by peers in the workplace.

The Kenyan residents also discussed the need for patient education in order to develop a shared understanding of a treatment plan that included manual therapy. The education provided to the patients resulted in a change in the patient's expectations for treatment and they were willing to be open to the use of new techniques. McSweeney et al. discussed the need to examine the differences between the healthcare professional's EM and the patient's EM before planning and providing treatment options.⁵⁸ Once the healthcare professional and the patient share an EM, they can negotiate a treatment plan that meets the patient's expressed health needs. Residents discussed this negotiation as they incorporated modalities into the treatment plan with the new manual therapy techniques. The residents were open to restructuring their EM to include modalities and to promote a shared understanding of the appropriate treatment plan.

The structure for healthcare provision in the country facilitated the ability to integrate the patients' preferences for treatment to include modalities. The majority of healthcare services in Kenya are provided through the public sector.⁵⁹ This has been achieved through healthcare facilities staffed by government employees and funded through budgets allocated from the government. The government allocates a portion of the national budget to provide healthcare for approximately 80 percent of the population.⁵⁹ The system promotes access to available services for all without

financial constraints on the patient. The lack of review of services by a private payer limits the accountability of providers to consider the depth and breadth of services provided that are supported by evidence-based practice. The freedom to incorporate the patient's traditional beliefs and expectations of western medicine allows for a shared explanatory model and development of a treatment plan that incorporates all treatments considered beneficial from both the provider and patient. Fostering the use of clinical reasoning by the residents may help further shift the scope of care in Kenya to one that is grounded in evidence based medicine based on the positive outcomes achieved from both the physical therapist and patient perspective.

As the residents progressed through the program and advanced their skill level, they discussed providing ongoing education to colleagues and an interest in lifelong learning. This supports the WCPT policy statement on education with physical therapists being committed to pursuing educational opportunities to promote the development of the profession.¹⁰ It also supports the continued growth of access to continuing education throughout the country of Kenya.

Provision of education to colleagues was also discussed as a facilitator for integrating skills in the clinic and changing current clinical practice. In addition to education of physical therapists, the residents provided education to patients and physicians regarding the changes in physical therapy practice. The Kenyan residents also described a gain in respect from their colleagues and members of the healthcare team fostered by their provision of continuing education to their colleagues. This reflected the change in the relationship of the physical therapist

within the healthcare team. The progression of the profession through residency education in Kenya supports the underlying assumptions of the BPCETF recommendations for expanding physical therapy education in the United States.¹⁶ The advanced education in Kenya lead not only to an improvement in the participating physical therapist's expertise, but a change in clinical practice and further incorporation of the physical therapist on the healthcare team.

As the residents discussed the progression of the profession through education, several of the APTA core values were examined.⁶⁰ Residents discussed accountability through the desire to advance their individual education. They were also committed to improving the quality of patient care within the healthcare system through the education of peers. The residents relayed the value of excellence through humility within interpersonal situations, as they provided consultations and continuing medical education to peers and assisted with their skill advancement. The engagement in providing education to others with the desire to promote the profession and patient outcomes also addresses the values of professional duty and social responsibility.⁶⁰ The residents demonstrated their ability to evolve into leaders within the profession and recognize the need for further development of the profession beyond orthopaedics.

Limitations and Delimitations

Delimitations included using a small sample of convenience from a single residency program in Nairobi, Kenya. The results of this study may not be generalizable to other residency programs, particularly those outside of Kenya . The advancement of knowledge, skills, and clinical reasoning in this study was measured

by the Practice Dimensions Examination, which uses a live patient examination to incorporate context specificity. This may not accurately represent the clinical practice of the residents.

Only 18 items on the PDE demonstrated a statistically significant change between entry and graduation of the program. The Bonferroni correction is conservative. Five additional items approached significance and may have achieved statistically significance change with a larger sample that would allow the use of less conservative approaches.

In addition, two items related to psychosocial factors in the examination and evaluation categories were consistently not applicable at the completion of the program. This may be due to the descriptors for the items and the cultural differences regarding an individual's response to injury or disability. The PDE provides a description of psychosocial factors to be addressed based on research findings from developed countries. Psychosocial factors associated with pain and disability measures have focused on pain catastrophizing and fear avoidance in the literature.^{61,62,63}

Associations between pain catastrophizing and disability measures have been shown in cross-sectional studies, however, prospective studies have not shown an association between pain catastrophizing and return to work.^{61,62} Severejins et al. found a relationship between pain catastrophizing and return to work in a cross-sectional sample of 1,164 patients with musculoskeletal pain.⁶¹ In contrast, a longitudinal study of 239 United States Navy personnel with low back pain demonstrated a lack of prospective association between pain catastrophizing and

return to work.⁶² A Besen, Gaines Linton and Shaw study found there was a relationship between pain severity and pain catastrophizing ($p < .01$), however, there was no relationship between pain severity and functional disability ($p > .01$).⁶³ They concluded individuals with high degrees of pain catastrophizing may fail to recognize opportunities for job modification. Therefore, the effects of pain catastrophizing on disability may vary methodological approach and occupational context.

In Kenya, coverage for work injuries is limited. Professional employees earning more than 4,000 shillings (\$40 USD) a month and those individuals that are self-employed are excluded from benefits.⁶⁴ Workers that qualify for temporary disability benefits have a maximum wage of 540 (\$5.40 USD) shillings a month. The maximum payment for temporary and permanent disability benefits is 240,000 shillings (\$2400 USD).⁶⁴ Therefore, the incentive for individuals with musculoskeletal pain to continue employment despite pain and disability is high. Pain catastrophizing and fear avoidance behaviors are not psychosocial factors recognized by the residents. On the contrary, injured employees are creative with their job modifications to allow continued full time employment. The goal of therapy is to work within the patient's constraints to find compensations that allow continued wage earning. This is consistent with research by Loisel and Côté whom concluded that work disability is multidimensional and involves pain beliefs, elements of workplace support, patient-provider communication, and system-wide policies.⁶⁵

Limitations in the qualitative assessment included potential bias in interpretation of the data. Potential bias may include comparing professional students in the United States to residents in Kenya, bias as professional educators, and unrealistic expectations of post-graduate education. To attempt to minimize bias, an investigator with no involvement in the initial proposal and data collection performed an external audit of the data. The utilization of a sample of convenience also limited the generalizability of the qualitative results.

Internal Validity

Maturation is a threat to the internal validity of this study. Development of clinical reasoning skills may have occurred through experiential learning as the physical therapists practiced over the 18-month period between the baseline and the final live patient practical examination. Maturation due to increased exposure to patient care may have occurred independently of the residency education. To determine the relationship between years of experience and clinical reasoning development, the 2014 pilot study examined this correlation. Spearman's rho was calculated at 0.054 for the variables of years of experience as a physical therapist and practical exam scores indicating little or no relationship.² This may suggest that maturation is not a threat in the study sample.

History is another threat to internal validity. Mentoring or access to continuing education experiences outside of the residency may have influenced the residents' clinical reasoning development, professional development, and career advancement. Qualitative interviews indicated two of the residents had mentoring available during their careers. None of the residents had access to additional formal

or continuing education since receiving their diploma in physiotherapy. The residents did not receive any additional education or mentoring during the timeframe of the residency program.

Regression towards the mean is also a threat to internal validity. Notably, in this study, two residents with previous mentoring (from a chiropractor trained in England) scored higher on the entry examination compared to residents without a history of mentoring. The mean percent change in score on the live patient examination for those two residents from entry until graduation was 18.25% compared to the mean change in score for all other residents of 53.74%. This may indicate regression towards the mean.

External Validity

The advancement of knowledge and clinical reasoning in this study was measured by the PDE, which uses a live patient examination to incorporate context specificity. The patients recruited for the practical examination may not accurately represent the clinical practice of the residents. Thirteen of the fourteen residents reported that the examination was a true representation of practice on the survey following the examination.

Implications of the Findings- Relevance to the Profession

The results of this study suggest the residency program was successful in promoting skill advancement, development of clinical reasoning skills, and ability to treat complex patients in diploma-level physical therapists in Kenya. In addition, the residents showed a willingness to share their new knowledge and skills with others through provision of continuing medical education to their colleagues and

promoting the progression of physical therapy as a profession within Kenya.

However, residents felt the absence of a degree limited their career advancement as employers did not recognize the higher diploma as advanced training.

This program may provide the framework for the development of additional residency programs in countries with limited educational resources. The model for replication of the program and its potential for on-going success was framed within the introduction the concept of residency education to the Nairobi community.

Richard Jackson, founder of the Jackson Clinics Foundation, held meeting with key stakeholders to determine common goals. The goals and scope of the program was shared with the University of Nairobi and Kenyatta University to ensure that misunderstandings did not ensue. This initial planning phase followed the four steps of moral imagination as developed by John Paul Lederach.⁶⁶ The four steps include the centrality of relationships, maintaining curiosity, creativity, and willingness to take a risk.⁶⁶ By developing shared goals for the program with key stakeholders, Mr. Jackson recognized regional interdependency for success of the program. He acknowledged that his actions would affect those currently practicing and teaching within the healthcare system.

Curiosity was also maintained within these initial meetings. Careful inquiries were made about the present needs within the profession of physical therapy and the focus with the focus placed on the experience of the Kenyan provider rather than the United States perspective of the current scope of practice. Creativity was expressed through the willingness to reshape the residency education and the programs goals based on these

discussions. Finally and most importantly, Mr. Jackson was willing to take a risk, as defined by Lederach discusses as the willingness to “step into the unknown without any guarantee of success or even safety.”⁶⁶

Key facilitators for participants in the residency program were identified as easy access to course materials, having an onsite administrator/coordinator as a point of contact, and the provision of mentoring in the clinic. Consistent funding of the program and recruitment of volunteer instructors from the United States, through the Jackson Clinics Foundation, was also a key facilitator for the programs success.

Residents also discussed providing education to other healthcare professionals regarding the change in their practice to include the advancement of clinical reasoning skills and utilization of manual therapy techniques. Developing residency programs should integrate teaching and learning into the curriculum to provide residents with the skills necessary to provide this valuable benefit to their colleagues. In addition, components of successful consultation should be included in the core curriculum. Residents could also benefit from the introduction of conflict resolution strategies to assist with the introduction of change in the clinic.

The development of residency programs that can influence the ability of physical therapists to provide treatment efficiently and effectively may ultimately assist in serving community physical therapy needs in underserved areas. According to the United Nations, 80 percent of all individuals with disabilities live in rural areas within developing countries without access to adequate medical treatment.⁶⁷ Physical therapists in these countries have an important role in the

treatment of disability and maintenance of quality of life. The residents in Kenya discussed the importance of providing education to peers in order to impact clinical practice as a whole in the country. Furthermore, the residents embraced the importance of furthering their education to allow for effective treatment of all patients. The challenge, however, remains in finding how to provide access to educational opportunities in these areas. It is also critical that educational and mentoring resources be available to healthcare providers to foster integration of evidenced-based practice into provision of care.

Recommendations for Future Research

The overarching goal of the residency program in Kenya is for the program to be self-sufficient by the year 2020. Five past residents currently act as teaching assistants for the modules and are gaining valuable mentoring as educators. As the program becomes self-sufficient, the outcomes should continue to be assessed to ensure program outcomes are consistently met and to explore the need for additional resources to safeguard the success of the program's transition. Furthermore, the impact of the residency program on patient outcomes and clinical practice should be explored with the graduate residents.

Appendix A

Higher Diploma in Orthopaedic Manual Therapy

Curricular Overview

Module 1: Clinical reasoning

Course reading-

- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.1: Clinical reasoning and evidence based practice
- Rothstein JM, Echternach JL, Riddle DL. Hypothesis-oriented algorithm for clinicians II (HOAC II): A guide for patient management. *Phys Ther.* 2003; 83(5): 455-470.
- Naber RI. Orthopaedic examination: from science to practice. 2009.

10-day onsite module

Written examination module 1

Practical examination module 1

Module 2: Upper extremity

Course reading-

- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.2: The Shoulder: Physical therapy patient management utilizing current evidence
- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.3: The Elbow: Physical therapy patient management utilizing current evidence
- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.4: The Wrist and Hand: Physical therapy patient management utilizing current evidence

10-day onsite module

Written examination module 2

Practical examination module 2

Module 3: Hip and Knee

Course reading-

- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.10: The Hip: Physical therapy patient management utilizing current evidence
- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.11: The Knee: Physical therapy patient management utilizing current evidence
- Cibulka et al. Hip pain and mobility deficits- Hip osteoarthritis: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2009;39(4): A1-A25.

- Loderstedt DS, Snyder-Mackler LS, Ritter RC, Axe MJ. Knee pain and mobility impairments: Meniscal and articular cartilage lesions. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2010; 40(6): A1-A35.
- Loderstedt DS, Snyder-Mackler LS, Ritter RC, Axe MJ, Godges JJ. Knee stability and movement coordination impairments: knee ligament sprain. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2010; 40(4): A1-A37.
- Nonarthritic Hip Joint. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2014; 44(6): A1-A32.

10-day onsite module

Written examination module 3

Practical examination module 3

Module 4: Ankle and Foot

Course reading-

- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.12 Foot and Ankle: Physical therapy patient management utilizing current evidence
- Carcia CR, Martin RL, Houck J, Wukich DE. Achilles pain, stiffness and muscle deficits: Achilles tendinitis. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2010; 40(9): A1-A26.
- Martin RL, Davenport TE, Paulseth S, Wukich DK, Godges JJ. Ankle stability and movement coordination impairments: Ankle ligament sprains. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2013; 43(9): A1-A40.

10-day onsite module

Written examination module 4

Practical examination module 4

Module 5: Lumbar spine and pelvis

Objectives-

Course reading-

- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.8 The Lumbar Spine: Physical therapy patient management utilizing current evidence

- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.9 The Pelvis and Sacroiliac Joint: Physical therapy patient management utilizing current evidence
- Delitto, George, Van Dillen, Whitman, Sowa, Shekelle, Denninger, Godges. Low Back Pain. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2012; 42(4): A1-A57.

10-day onsite module

Written examination module 5

Practical examination module 5

Module 6: Cervical spine, Thoracic spine and TMJ

Course reading-

- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.5 The Temporomandibular Joint: Physical therapy patient management utilizing current evidence
- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.6 The Cervical Spine: Physical therapy patient management utilizing current evidence
- Current Concepts of Orthopaedic Physical Therapy, 3rd edition. Independent study course 21.2.7 The Thoracic Spine and Rib Cage: Physical therapy patient management utilizing current evidence
- Childs, Cleland JE, Elliott JM, Teyhen DS, Wainner RS, Whitman JM, Sopky BJ, Godges JJ, Flynn TW. Neck Pain: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Ortho Sports Phys Ther.* 2008; 38(9): A1-A34.

10-day onsite module

Written examination module 6

Practical examination module 6

Final comprehensive written examination

Final live patient examination

Appendix B

Practice Dimensions Examination

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

EXAMINATION

	Unsatisfactory performance	Satisfactory Performance	Not applicable
1. Examination			
a. Obtain a history/perform an interview			
(1) Adjust communication style to best build rapport with the patient			
(2) Adjust communication to best match the patient's cognitive level and learning style			
(3) Identify the patient's current level of activity and ability to participate in desired tasks (residents must discuss either current level of activity <i>or</i> desired activity for satisfactory score).			
(4) Identify the <i>area(s)</i> of the patient's symptoms (24 hour time period or time to symptom resolution following onset)			
(5) Identify the <i>time behavior</i> of the symptoms.			
(6) Identify the <i>level of irritability or severity</i> of the symptoms (intensity of the pain in relation to the provoking physical stress/activity). Resident must ask activities that provoke symptoms and intensity of pain with those activities.			
(7) Identify the symptom's <i>aggravating factors</i>			
(8) Identify the symptom's <i>easing factors</i>			
(9) Identify other therapeutic interventions employed by the patient and their <i>usefulness</i> (Resident must request information regarding previous treatment, modalities, self care <i>and/or</i> medications)			
(10) Identify the patient's response to his/her current clinical situation (including psychosocial factors)			
b. Examination/Re-examination. Administration of selected specific tests and measures, when appropriate.			
(11) Assess Current level of function using a self report questionnaire			
(12) Assess pain levels			
(13) Assess static postural alignment in either a sitting or standing position (visual assessment is adequate)			
(14) Assess gait, locomotion and/or balance (Does the resident observe the patient's gait or perform a balance assessment?)			
(15) Assess extremity integumentary and joint tissue quality (e.g., signs of inflammation, effusion)			
(16) Assess extremity circulation (e.g., VBI, PVD) <i>if applicable</i>			
(17) Assess sensation, proprioception, and reflexes (Must perform 2 out of 3 neurological tests CORRECTLY)			
(18) Assess active range of motion and movement/pain relations (Resident must perform both AROM/movement <i>and</i> note its relation to the patient's pain)			
(19) Assess extremity joint passive mobility (e.g., range of motion, movement/pain relations)			
(20) Assess <u>extremity joint</u> accessory/joint play motions (Resident must assess joint glide <i>and</i> distraction)			
(21) Assess <u>spinal segmental</u> mobility (e.g., mobility and movement/pain relations)			
(22) Assess joint integrity (e.g., ligamentous stress tests)			

(23) Assess muscle flexibility/muscle length (prom more than 1 muscle with an objective measure)			
(24) Assess nerve mobility (e.g., range of motion, movement/pain relations)			
(25) Assess soft tissue mobility (e.g., fascia, myofascia, nerve entrapment sites)			
(26) Assess response of connective tissues (e.g., ligament, bone) to palpatory provocation.			
(27) Assess response of muscle tissues (e.g., trigger points) to palpatory provocation.			
(28) Assess muscle power – strength, endurance			
(29) Assess muscle power – Resident must recognize the relationship between muscle contraction and pain provocation. (e.g., contractile tissue response to tests)			

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

EVALUATION

	Unsatisfactory performance	Satisfactory Performance	Not applicable
2. Evaluation – The following information should be <u>assessed during the interview</u>			
a. Interpret data from history			
(30) Identifying relevant, consistent, and accurate data			
(31) Prioritize reported functional limitations and activity restrictions (Resident must identify most significant/ primary functional restriction and at least one other)			
(32) Assess the patient’s needs, motivations, and goals (e.g., assessing the patient’s perspective related to his/her activity limitations or disablement)			
b. Develop working diagnosis (hypothesis)			
(33) Develop working diagnosis (hypothesis) for <i>possible contraindications for physical therapy intervention when applicable to the patient.</i> Unsatisfactory Performance: Not recognizing a contraindication when present Satisfactory Performance: Recognizing a contraindication to treatment when present Not Applicable: No contraindication present			
(34) Identify the <i>type/nature</i> of the patient’s symptoms (e.g., potential condition(s) that may be associated with the symptoms) Cue resident: inflammatory processes, mechanical/physical stress to somatic tissue, involvement of neural elements, or psychological impairments).			
(35) Develop working diagnosis (hypothesis) for the <i>stage of condition</i> (e.g. acute, subacute, settled, recurring or chronic)			
(36) Develop working diagnosis (hypothesis) for the <i>anatomical structures</i> involved with the complaint(s)			
(37) Develop working diagnosis (hypothesis) for the <i>probable cause(s)</i> of the complaint(s) (Nature: primary forces leading to the condition e.g., shear, compression, tension, neurological, cognitive)			
c. Plan the physical examination/select tests and measures			
(38) Select tests and measures that are <i>consistent with the history</i> for verifying or refuting the working diagnosis			
d. Interpret data from the physical examination (Determine during interview)			

(39) Assess movement coordination (e.g., quality of movement, scapulothoracic humeral rhythm, smoothness or movement pursuit)			
(40) Interpret data from the history and physical examination – related to the <i>irritability of the condition(s)</i> (<i>High, moderate or low irritability</i>) High Irritability: high pain $\geq 7/10$, consistent resting pain, pain prior to end ranges Moderate Irritability: mod. pain 4-6/10, intermittent resting pain, pain at end ROM Low Irritability: low pain $\leq 3/10$, no resting pain, pain with overpressures into end ranges			
(41) Interpret data from the examination – related to <i>psychosocial factors</i> (Psychosocial factors include anxiety, fear avoidance, depression, pain catastrophizing, self efficacy, economic resources, social support, employment, immediate supervisor, etc.)			
e. Select intervention approach (Determine during interview)			
(42) Decides when clinical findings warrant additional diagnostic testing or medical intervention prior to or in conjunction with physical therapy intervention) Unsatisfactory Performance: Referral necessary and not performed/ or unnecessary tests recommended Satisfactory Performance: Referral necessary and performed correctly Not Applicable: No referral necessary			
(43) Select <u>generalized</u> intervention approach, as appropriate, to include physical therapy intervention <i>ie manual therapy, patient education etc.</i> (Intervention must match impairments discovered during evaluation. e.g., if muscle flexibility is not assessed, stretching would be inappropriate)			
(44) Select intervention approach, as appropriate, to include <i>further examination</i> (Determine whether or not enough information been gathered to adequately formulate a working diagnosis, initiate treatment, and/or whether further data should be collected)			
f. Respond to emerging data from examinations and interventions. The following information should be assessed during the interview			
(45) Respond to emerging data from examinations and interventions by <i>modifying</i> the <u>current</u> intervention if applicable (e.g. hand placement or intensity) Unsatisfactory Performance: Modification required and not performed Satisfactory Performance: Modification required and performed correctly Not Applicable: Modification is not required			
(46) Respond to emerging data from examinations and interventions by <i>redirecting</i> the intervention (e.g. changing the type of intervention based on the patient response) Unsatisfactory Performance: Redirection of intervention required and not performed Satisfactory Performance: Redirection of intervention required and performed correctly Not Applicable: Redirection of intervention is not required			

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

DIAGNOSIS

	Unsatisfactory performance	Satisfactory Performance	Not applicable
3. Diagnosis- The following information should be assessed during the interview. If the resident demonstrates adequate clinical reasoning for the response, a satisfactory score will be determined.			
(47) Based on the evaluation, organize data into recognized clusters, syndromes, or categories			
(48) Based on the <i>diagnosis</i> , report the <i>most appropriate</i> (primary) intervention approach This intervention approach based on the patient's <u>diagnosis</u> and does not need to include specific interventions matched to each identified impairment in the examination.			

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

PROGNOSIS

	Unsatisfactory performance	Satisfactory Performance	Not applicable
4. Prognosis- The following information should be assessed during the interview. If the resident demonstrates adequate clinical reasoning for the response, a satisfactory score will be determined.			
a. Choose assessment measures			
(49) Choose re-assessment measures to determine <i>initial</i> responses to intervention (e.g., within <u>current</u> treatment session to determine effectiveness of technique)			
(50) Choose re-assessment measures to determine <i>long-term</i> responses to intervention (e.g., correlate back to long term goals)			
b. Establish plan of care			
(51) Establish plan of care, <i>selecting</i> specific interventions based on impairments <i>Interventions must be based on the impairments noted in examination</i>			
(52) Establish plan of care, <i>prioritizing</i> specific interventions based on impairments <i>Interventions must be based on the impairments noted in examination</i>			
c. Prognosticate regarding function			
(53) Predict the <i>optimal level</i> of function that the patient will achieve			
(54) Predict the <i>amount of time</i> needed to reach the optimal level of function			

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

INTERVENTION

	Unsatisfactory performance	Satisfactory Performance	Not applicable
5. Intervention			
a. Provide patient education related to the plan of care			
(55) Educate patient on his/her <i>diagnosis</i>			
(56) Educate patient on his/her <i>prognosis</i>			
(57) Educate patient on his/her <i>treatment plan</i> (e.g. modalities, exercise, joint mobilization) Resident must clearly outline the treatment plan.			
(58) Educate patient on his/her <i>responsibility or role</i> in the plan of care (home exercises, activity modification, etc)			
b. Implement therapeutic exercise			
(59) Implement therapeutic exercise to improve <i>mobility</i> (stretching/ self mobilization exercises). Must be consistent with exam findings.			
(60) Implement therapeutic exercise to improve <i>muscle performance</i> (specific strengthening exercises) Must be consistent with exam findings.			
c. Implement manual therapy procedures			
(61) Implement manual therapy procedures – <i>soft tissue mobilization</i> (Techniques must match exam findings)			
(62) Implement manual therapy procedures – <i>Manual passive range of motion</i>			
(63) Implement manual therapy procedures – <i>joint mobilization</i> (Techniques must match exam findings)			
(64) Implement manual therapy procedures – <i>joint manipulation</i>			

Appendix C
Frequency Counts for Items on The PDE

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS EXAMINATION	Frequencies prior to residency	Frequencies following residency
(1) Adjust communication style to best build rapport with the patient	UP - SP 14/ 100% NA -	UP - SP 14/100% NA -
(2) Adjust communication to best match the patient's cognitive level and learning style	UP - SP 14/100% NA -	UP - SP 14/100% NA -
(3) Identify the patient's current level of activity and ability to participate in desired tasks (residents must discuss either current level of activity <i>or</i> desired activity for satisfactory score).	UP 8/57.1% SP 6/42.9% NA 0/0%	UP - SP 11/78.6% NA 3/21.4%
(4) Identify the <i>area(s)</i> of the patient's symptoms (24 hour time period or time to symptom resolution following onset)	UP 1/7.1% SP 13/92.9% NA -	UP 1/7.1% SP 13/92.9% NA
(5) Identify the <i>time behavior</i> of the symptoms.	UP 11/78.6% SP 2/14.3% NA -	UP 4/ 28.6% SP 10/71.4% NA -
(6) Identify the <i>level of irritability or severity</i> of the symptoms (intensity of the pain in relation to the provoking physical stress/activity). Resident must ask activities that provoke symptoms and intensity of pain with those activities.	UP 9/64.3% SP 5/35.7% NA -	UP 3/21.4% SP 11/78.6% NA -
(7) Identify the symptom's <i>aggravating factors</i>	UP 7/50% SP 7/50% NA -	UP - SP 14/100% NA -
(8) Identify the symptom's <i>easing factors</i>	UP 10/71.4% SP 4/28.6% NA -	UP 2/14.3% SP 12/85.7% NA -
(9) Identify other therapeutic interventions employed by the patient and their <u>usefulness</u> (Resident must request information regarding previous treatment, modalities, self care <i>and/or</i> medications)	UP 9/64.3% SP 5/35.7% NA -	UP - SP 14/100% NA -
(10) Identify the patient's response to his/her current clinical situation (including psychosocial factors)	UP 4/28.6% SP 3/21.4% NA 7/50%	UP - SP - NA 14/100%
(11) Assess Current level of function using a self report questionnaire	UP 14/100% SP - NA -	UP 6/42.9% SP 7/50% NA 1/7.1%
(12) Assess pain levels	UP 10/71.4% SP 4/28.6% NA -	UP 1/7.1% SP 13/92.9% NA -
(13) Assess static postural alignment in either a sitting or standing position (visual assessment is adequate)	UP 9/64.3% SP 4/28.6% NA 1/7.1%	UP 2/14.3% SP 12/85.7% NA -
(14) Assess gait, locomotion and/or balance (Does the resident observe the patient's gait or perform a balance assessment?)	UP 6/42.9% SP 4/28.6% NA 4/28.6%	UP 5/35.7% SP 4/28.6% NA 5/50%
(15) Assess extremity integumentary and joint tissue quality (e.g., signs of inflammation, effusion)	UP 12/85.7% SP 1/7.1% NA 1/7.1%	UP - SP 1/7.1% NA 13/92.9%
(16) Assess extremity circulation (e.g., VBI, PVD) <i>if applicable</i>	UP - SP - NA 14/100%	UP - SP - NA 14/100%
(17) Assess sensation, proprioception, and reflexes (Must perform 2 out of 3 neurological tests CORRECTLY)	UP 12/85.7% SP 1/7.1% NA 1/7.1%	UP 5/ 35.7 SP 4/ 28.6% NA 5/ 35.7%
(18) Assess active range of motion and movement/pain relations (Resident must perform both AROM/movement <i>and</i> note its relation to the patient's pain	UP 3/21.4% SP 11/78.6% NA -	UP - SP 14/100% NA -
(19) Assess extremity joint passive mobility (e.g., range of motion, movement/pain relations)	UP 8/57.1% SP 6/42.9% NA -	UP - SP 14/100% NA -
(20) Assess <u>extremity joint</u> accessory/joint play motions (Resident must assess joint glide <i>and</i> distraction)	UP 8/57.1% SP 2/14.3% NA 4/28.6%	UP 2/14.3 SP 1/7.1 NA 11/78.6
(21) Assess <u>spinal segmental</u> mobility (e.g., mobility and movement/pain relations)	UP 6/42.9% SP 3/21.4% NA 5/35.7%	UP 2/14.3 SP 10/71.4 NA 2/14.3

(22) Assess joint integrity (e.g., ligamentous stress tests)	UP 8/57.1% SP 5/35.7% NA 1/7.1%	UP 2/14.3% SP 12/85.7% NA -
(23) Assess muscle flexibility/muscle length (prom more than 1 muscle with an objective measure)	UP 11/78.6% SP 2/14.3% NA 1/7.1%	UP 8/57.1% SP 6/42.9% NA -
(24) Assess nerve mobility (e.g., range of motion, movement/pain relations)	UP 10/71.4% SP 2/14.3% NA 2/14.3%	UP 2/14.3% SP 9/64.3% NA 3/21.4%
(25) Assess soft tissue mobility (e.g., fascia, myofascia, nerve entrapment sites)	UP 11/78.6% SP 1/7.1% NA 2/14.3%	UP 5/35.7% SP 8/57.1% NA 1/7.1%
(26) Assess response of connective tissues (e.g., ligament, bone) to palpatory provocation.	UP 9/64.3% SP 4/28.6% NA 1/7.1%	UP 1/7.1% SP 13/ 92.9% NA -
(27) Assess response of muscle tissues (e.g., trigger points) to palpatory provocation.	UP 6/42.9% SP 7/50.0% NA 1/7.1%	UP 2/14.3% SP 12/85.7% NA-
(28) Assess muscle power – strength, endurance	UP 11/78.6% SP 3/21.4% NA -	UP 2/14.3% SP 11/78.6% NA 1/7.1%
(29) Assess muscle power – Resident must recognize the relationship between muscle contraction and pain provocation. (e.g., contractile tissue response to tests)	UP 8/57.1% SP 2/14.3% NA 4/28.6%	UP 2/14.3% SP 5/35.7% NA 7/50%

UP= unsatisfactory performance; SP= satisfactory performance; NA= Not applicable

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS EVALUATION	Frequencies prior to residency	Frequencies following residency
(30) Identifying relevant, consistent, and accurate data	UP 12/85.7% SP - NA 2/14.3%	UP 1/7.1% SP 13/92.9% NA -
(31) Prioritize reported functional limitations and activity restrictions (Resident must identify most significant/ primary functional restriction and at least one other)	UP 14/100% SP - NA -	UP - SP 14/100% NA -
(32) Assess the patient's needs, motivations, and goals (e.g., assessing the patient's perspective related to his/her activity limitations or disablement)	UP 5/35.7% SP 9/ 64.3% NA -	UP - SP 14/100% NA -
(33) Develop working diagnosis (hypothesis) for <i>possible contraindications for physical therapy intervention when applicable to the patient.</i> Unsatisfactory Performance: Not recognizing a contraindication when present Satisfactory Performance: Recognizing a contraindication to treatment when present Not Applicable: No contraindication present	UP 12/85.7% SP 1/7.1% NA 1/7.1%	UP - SP 4/28.6 NA 10/71.4%
(34) Identify the <i>type/nature</i> of the patient's symptoms (e.g., potential condition(s) that may be associated with the symptoms) Cue resident: inflammatory processes, mechanical/physical stress to somatic tissue, involvement of neural elements, or psychological impairments).	UP 14/100% SP - NA -	UP 1/7.1 SP 13/92.9% NA -
(35) Develop working diagnosis (hypothesis) for the <i>stage of condition</i> (e.g. acute, subacute, settled, recurring or chronic)	UP 14/100% SP- NA-	UP 1/7.1% SP 13/ 92.9% NA-
(36) Develop working diagnosis (hypothesis) for the <i>anatomical structures</i> involved with the complaint(s)	UP 9/64.3% SP 5/35.7% NA	UP - SP 14/100% NA -
(37) Develop working diagnosis (hypothesis) for the <i>probable cause(s)</i> of the complaint(s) (Nature: primary forces leading to the condition e.g., shear, compression, tension, neurological, cognitive)	UP 14/100% SP - NA -	UP 3/21.4 SP 11/78.6% NA -
(38) Select tests and measures that are <i>consistent with the history</i> for verifying or refuting the working diagnosis	UP 12/85.7% SP 2/7.1% NA 1/7.1%	UP 1/7.1% SP 13/92.9% NA -
(39) Assess movement coordination (e.g., quality of movement, scapulothoracic humeral rhythm, smoothness or movement pursuit)	UP 4/28.6% SP 2/14.3% NA 8/57.1%	UP - SP 14/100% NA

(40) Interpret data from the history and physical examination – related to the <i>irritability of the condition(s)</i> (<i>High, moderate or low irritability</i>) High Irritability: high pain $\geq 7/10$, consistent resting pain, pain prior to end ranges Moderate Irritability: mod. pain 4-6/10, intermittent resting pain, pain at end ROM Low Irritability: low pain $\leq 3/10$, no resting pain, pain with overpressures into end ranges	UP 14/100% SP - NA -	UP 1/7.1% SP 13/92.9% NA -
(41) Interpret data from the examination – related to <i>psychosocial factors</i> (Psychosocial factors include anxiety, fear avoidance, depression, pain catastrophizing, self efficacy, economic resources, social support, employment, immediate supervisor, etc.)	UP 14/100% SP - NA -	UP SP NA 14/100%
(42) Decides when clinical findings warrant additional diagnostic testing or medical intervention prior to or in conjunction with physical therapy intervention) Unsatisfactory Performance: Referral necessary and not performed/ or unnecessary tests recommended Satisfactory Performance: Referral necessary and performed correctly Not Applicable: No referral necessary	UP 14/100% SP - NA -	UP 1/7.1% SP 2/85.7% NA 1/7.1%
(43) Select <u>generalized</u> intervention approach, as appropriate, to include physical therapy intervention <i>ie manual therapy, patient education etc.</i> (Intervention must match impairments discovered during evaluation. e.g., if muscle flexibility is not assessed, stretching would be inappropriate)	UP 13/100% SP 1/7.1% NA -	UP 3/21.4% SP 11/78.6% NA -
(44) Select intervention approach, as appropriate, to include <i>further examination</i> (Determine whether or not enough information been gathered to adequately formulate a working diagnosis, initiate treatment, and/or whether further data should be collected)	UP 14/100% SP - NA -	UP 1/7.1% SP 12/85.7% NA 1/7.1%
(45) Respond to emerging data from examinations and interventions by <i>modifying</i> the <u>current</u> intervention if applicable (e.g. hand placement or intensity) Unsatisfactory Performance: Modification required and not performed Satisfactory Performance: Modification required and performed correctly Not Applicable: Modification is not required	UP 7/50.0% SP 7/50.0% NA -	UP 1/7.1% SP 4/28.6% NA 9/64.3%
(46) Respond to emerging data from examinations and interventions by <i>redirecting</i> the intervention (e.g. changing the type of intervention based on the patient response) Unsatisfactory Performance: Redirection of intervention required and not performed Satisfactory Performance: Redirection of intervention required and performed correctly Not Applicable: Redirection of intervention is not required	UP 5/35.7% SP 1/7.1% NA 8/57.1%	UP 1/7.1% SP 4/28.6% NA 9/64.3%

UP= unsatisfactory performance; SP= satisfactory performance; NA= Not applicable

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS DIAGNOSIS	Frequencies prior to residency	Frequencies following residency
(47) Based on the evaluation, organize data into recognized clusters, syndromes, or categories	UP 11/78.6% SP 3/21.4% NA -	UP - SP 14/100% NA -
(48) Based on the <i>diagnosis</i> , report the <i>most appropriate</i> (primary) intervention approach This intervention approach based on the patient's <u>diagnosis</u> and does not need to include specific interventions matched to each identified impairment in the examination.	UP 12/85.7% SP 2/14.3% NA -	UP - SP 14/100% NA -

UP= unsatisfactory performance; SP= satisfactory performance; NA= Not applicable

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS PROGNOSIS	Frequencies prior to residency	Frequencies following residency
(49) Choose re-assessment measures to determine <i>initial</i> responses to intervention (e.g., within <u>current</u> treatment session to determine effectiveness of technique)	UP 13/92.9% SP - NA 1/7.1%	UP 1/7.1% SP 13/92.9% NA -
(50) Choose re-assessment measures to determine <i>long-term</i> responses to intervention (e.g., correlate back to long term goals)	UP 13/92.9% SP - NA 1/7.1%	UP 1/7.1% SP 13/92.9% NA -
(51) Establish plan of care, <i>selecting</i> specific interventions based on impairments <i>Interventions must be based on the impairments noted in examination</i>	UP 13/92.9% SP 1/7.1% NA -	UP - SP 14/100% NA
(52) Establish plan of care, <i>prioritizing</i> specific interventions based on impairments <i>Interventions must be based on the impairments noted in examination</i>	UP 14/100% SP - NA -	UP - SP 14/100% NA -
(53) Predict the <i>optimal level</i> of function that the patient will achieve	UP 11/78.6% SP 3/21.4% NA -	UP 1/7.1% SP 13/92.9% NA
(54) Predict the <i>amount of time</i> needed to reach the optimal level of function	UP 14/100% SP - NA -	UP 3/21.4% SP 11/78.6% NA -

UP= unsatisfactory performance; SP= satisfactory performance; NA= Not applicable

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS INTERVENTION	Frequencies prior to residency	Frequencies following residency
(55) Educate patient on his/her <i>diagnosis</i>	UP 10/71.4% SP 3/21.4% NA 1/7.1%	UP 6/42.9% SP 8/57.1% NA -
(56) Educate patient on his/her <i>prognosis</i>	UP 13/92.9% SP - NA 1/7.1%	UP 6/42.9% SP 8/57.1% NA -
(57) Educate patient on his/her <i>treatment plan</i> (e.g. modalities, exercise, joint mobilization) Resident must clearly outline the treatment plan.	UP 9/64.3% SP 4/28.6% NA 1/7.1%	UP 3/21.4% SP 11/78.6% NA -
(58) Educate patient on his/her <i>responsibility or role</i> in the plan of care (home exercises, activity modification, etc)	UP 14/100% SP - NA -	UP 1/7.1% SP 13/92.9% NA
(59) Implement therapeutic exercise to improve <i>mobility</i> (stretching/ self mobilization exercises). Must be consistent with exam findings.	UP 12/85.7% SP 1/7.1% NA 1/7.1%	UP 2/14.3% SP 12/85.7% NA -
(60) Implement therapeutic exercise to improve <i>muscle performance</i> (specific strengthening exercises) Must be consistent with exam findings.	UP 12/85.7% SP 1/7.1% NA 1/7.1%	UP 3/21.4% SP 10/71.4% NA 1/7.1%
(61) Implement manual therapy procedures – <i>soft tissue mobilization</i> (Techniques must match exam findings)	UP 14/100% SP - NA -	UP 4/28.6% SP 10/71.4% NA -
(62) Implement manual therapy procedures – <i>Manual passive range of motion</i>	UP 5/35.7% SP 1/7.1% NA 8/57.1%	UP - SP 5/35.7% NA 9/64.3%
(63) Implement manual therapy procedures – <i>joint mobilization</i> (Techniques must match exam findings)	UP 14/100% SP - NA -	UP 1/7.1% SP 13/92.9% NA -
(64) Implement manual therapy procedures – <i>joint manipulations</i>	UP 14/100% SP - NA -	UP - SP - NA 14/100%

UP= unsatisfactory performance; SP= satisfactory performance; NA= Not applicable

Appendix D

Resident Scores on the PDE Prior to and Following Completion of the Residency Program

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

EXAMINATION

	Mean, mode and median prior to residency education	Mean, mode and median following residency education	Sig. Wilcoxon / McNemar
1. Examination			
a. Obtain a history/perform an interview			
(1) Adjust communication style to best build rapport with the patient	2.00/2/2.00	2.00/2/2.00	1.00/-
(2) Adjust communication to best match the patient's cognitive level and learning style	2.00/2/2.00	2.00/2/2.00	1.00/-
(3) Identify the patient's current level of activity and ability to participate in desired tasks (residents must discuss either current level of activity <i>or</i> desired activity for satisfactory score).	1.43/1/1.00	2.00/2/2.00	0.008/0.016
(4) Identify the <i>area(s)</i> of the patient's symptoms (24 hour time period or time to symptom resolution following onset)	1.93/2/2.00	1.93/2/2.00	1.00/1.00
(5) Identify the <i>time behavior</i> of the symptoms.	1.21/1/1.00	1.71/2/2.00	0.020/0.039
(6) Identify the <i>level of irritability or severity</i> of the symptoms (intensity of the pain in relation to the provoking physical stress/activity). Resident must ask activities that provoke symptoms and intensity of pain with those activities.	1.36/1/1.00	1.79/2/2.00	0.083/0.146
(7) Identify the symptom's <i>aggravating factors</i>	1.50/1/1.50	2.00/2/2.00	0.008/0.016
(8) Identify the symptom's <i>easing factors</i>	1.29/1/1.00	1.86/2/2.00	0.021/0.039
(9) Identify other therapeutic interventions employed by the patient and their <i>usefulness</i> (Resident must request information regarding previous treatment, modalities, self care <i>and/or</i> medications)	1.36/1/1.00	2.00/2/2.00	0.003/0.004
(10) Identify the patient's response to his/her current clinical situation (including psychosocial factors)	1.43/1/1.00	-	-
b. Examination/Re-examination. Administration of selected specific tests and measures, when appropriate.			
(11) Assess Current level of function using a self report questionnaire	1.00/1/1.00	1.54/2/2.00	0.008/0.016
(12) Assess pain levels	1.29/1/1.00	1.93/2/2.00	0.003/0.004
(13) Assess static postural alignment in either a sitting or standing position (visual assessment is adequate)	1.31/1/1.00	1.86/2/2.00	0.035/0.065
(14) Assess gait, locomotion and/or balance (Does the resident observe the patient's gait or perform a balance assessment?)	1.40/1/1.00	1.62/2/2.00	0.414/0.688
(15) Assess extremity integumentary and joint tissue quality (e.g., signs of inflammation, effusion)	1.08/1/1.00	-	-
(16) Assess extremity circulation (e.g., VBI, PVD) <i>if applicable</i>	-	-	-
(17) Assess sensation, proprioception, and reflexes (Must perform 2 out of 3 neurological tests CORRECTLY)	1.21/1/1.00	1.60/1/1.50	0.257/-
(18) Assess active range of motion and movement/pain relations (Resident must perform both AROM/movement <i>and</i> note its relation to the patient's pain)	1.79/2/2.00	2.00/2/2.00	0.083/0.250
(19) Assess extremity joint passive mobility (e.g., range of motion, movement/pain relations)	1.43/1/1.00	2.00/2/2.00	0.317/1.00
(20) Assess <u>extremity joint</u> accessory/joint play motions (Resident must assess joint glide <i>and</i> distraction)	1.40/1/1.00	2.00/2/2.00	-/1.00
(21) Assess <u>spinal segmental</u> mobility (e.g., mobility and movement/pain relations)	1.33/1/1.00	1.83/2/2.00	0.180/0.375

(22) Assess joint integrity (e.g., ligamentous stress tests)	1.38/1/1.00	1.86/2/2.00	0.034/0.070
(23) Assess muscle flexibility/muscle length (prom more than 1 muscle with an objective measure)	1.15/1/1.00	1.43/1/1.00	0.180/0.375
(24) Assess nerve mobility (e.g., range of motion, movement/pain relations)	1.17/1/1.00	1.92/2/2.00	0.008/0.016
(25) Assess soft tissue mobility (e.g., fascia, myofascia, nerve entrapment sites)	1.08/1/1.00	1.71/2/2.00	0.014/0.031
(26) Assess response of connective tissues (e.g., ligament, bone) to palpatory provocation.	1.31/1/1.00	1.93/2/2.00	0.011/0.021
(27) Assess response of muscle tissues (e.g., trigger points) to palpatory provocation.	1.54/2/2.00	1.86/2/2.00	0.157/0.289
(28) Assess muscle power – strength, endurance	1.21/1/1.00	1.85/2/2.00	0.005/0.008
(29) Assess muscle power – Resident must recognize the relationship between muscle contraction and pain provocation. (e.g., contractile tissue response to tests)	1.20/1/1.00	1.71/2/2.00	0.083/0.250

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

EVALUATION

	Mean, mode and median prior to residency education	Mean, mode and median following residency education	Sig. Wilcoxon / McNemar
2. Evaluation – The following information should be assessed during the interview			
a. Interpret data from history			
(30) Identifying relevant, consistent, and accurate data	1.00/1/1.00	1.93/2/2.00	*0.001/0.001
(31) Prioritize reported functional limitations and activity restrictions (Resident must identify most significant/ primary functional restriction and at least one other)	1.00/1/1.00	2.00//2.002	*0.000/0.000
(32) Assess the patient's needs, motivations, and goals (e.g., assessing the patient's perspective related to his/her activity limitations or disablement)	1.62/2/2.00	2.00/2/2.00	0.025/ 0.063
b. Develop working diagnosis (hypothesis)			
(33) Develop working diagnosis (hypothesis) for <i>possible contraindications for physical therapy intervention when applicable to the patient.</i> Unsatisfactory Performance: Not recognizing a contraindication when present Satisfactory Performance: Recognizing a contraindication to treatment When present Not Applicable: No contraindication present	1.36/1/1.00	1.60/2/2.00	-
(34) Identify the <i>type/nature</i> of the patient's symptoms (e.g., potential condition(s) that may be associated with the symptoms) Cue resident: inflammatory processes mechanical /physical stress to somatic tissue of neural elements or psychological impairments	1.15/1/1.00	2.00/2/2.00	*0.001/0.001
(35) Develop working diagnosis (hypothesis) for the <i>stage of condition</i> (e.g. acute, subacute, settled, recurring or chronic)	1.75/2/2.00	1.93/2/2.00	*0.000/0.000
(36) Develop working diagnosis (hypothesis) for the <i>anatomical structures</i> involved with the complaint(s)	1.36/1/1.00	2.00/2/2.00	0.003/ 0.004

(37) Develop working diagnosis (hypothesis) for the <i>probable cause(s)</i> of the complaint(s) (Nature: primary forces leading to the condition e.g., shear, compression, tension, neurological, cognitive)	1.00/1/1.00	1.79/2/2.00	*0.001/0.001
c. Plan the physical examination/select tests and measures			
(38) Select tests and measures that are <i>consistent with the history</i> for verifying or refuting the working diagnosis	1.08/1/1.00	1.93/2/2.00	*0.001/0.001
d. Interpret data from the physical examination (Determine during interview)			
(39) Assess movement coordination (e.g., quality of movement, scapulothoracic humeral rhythm, smoothness or movement pursuit)	1.00/1/1.00	2.00/2/2.00	*0.000/0.000
(40) Interpret data from the history and physical examination – related to the <i>irritability of the condition(s)</i> (<i>High, moderate or low irritability</i>) High Irritability: high pain $\geq 7/10$, consistent resting pain, pain prior to end ranges Moderate Irritability: mod. pain 4-6/10, intermittent resting pain, pain at end ROM Low Irritability: low pain $\leq 3/10$, no resting pain, pain with overpressures into end ranges	1.00/1/1.00	1.93/2/2.00	*0.000/0.000
(41) Interpret data from the examination – related to <i>psychosocial factors</i> (Psychosocial factors include anxiety, fear avoidance, depression, pain catastrophizing, self efficacy, economic resources, social support, employment, immediate supervisor, etc.)	-	-	-
e. Select intervention approach (Determine during interview)			
(42) Decides when clinical findings warrant additional diagnostic testing or medical intervention prior to or in conjunction with physical therapy intervention) Unsatisfactory Performance: Referral necessary and not performed/ or unnecessary tests recommended Satisfactory Performance: Referral necessary and performed correctly Not Applicable: No referral necessary	1.00/1/1.00	2.00/2/2.00	*0.000/0.000
(43) Select <u>generalized</u> intervention approach, as appropriate, to include physical therapy intervention <i>ie manual therapy, patient education etc.</i>	1.00/1/1.00	1.79/2/2.00	0.002/ 0.002
(44) Select intervention approach, as appropriate, to include <i>further examination</i> (Determine whether or not enough information been gathered to adequately formulate a working diagnosis, initiate treatment, and/or whether further data should be collected)	1.00/1/1.00	1.92/2/2.00	*0.001/0.001
f. Respond to emerging data from examinations and interventions.			
(45) Respond to emerging data from examinations and interventions by <u>modifying the current</u> intervention if applicable (e.g. hand placement or intensity) Unsatisfactory Performance: Modification required and not performed Satisfactory Performance: Modification required and performed correctly Not Applicable: Modification is not required	1.00/1/1.00	1.80/2/2.00	0.157/ 0.500
(46) Respond to emerging data from examinations and interventions by <u>redirecting</u> the intervention (e.g. changing the type of intervention based on the patient response) Unsatisfactory Performance: Redirection of intervention required and not performed Satisfactory Performance: Redirection of intervention required and performed correctly Not Applicable: Redirection of intervention is not required	1.17/1/1.00	1.80/2/2.00	0.083/ 0.250

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

DIAGNOSIS

	Mean, mode and median prior to residency education	Mean, mode and median following residency education	Sig Wilcoxon 3/Wilcoxon 2/ McNemar
6. Diagnosis- The following information should be assessed during the interview. If the resident demonstrates adequate clinical reasoning for the response, a satisfactory score will be determined.			
(47) Based on the evaluation, organize data into recognized clusters, syndromes, or categories	1.21/1/1.00	2.00/2/2.00	*0.001/0.001/0.001
(48) Based on the <i>diagnosis</i> , report the <i>most appropriate</i> (primary) intervention approach This intervention approach based on the patient's <u>diagnosis</u> and does not need to include specific interventions matched to each identified impairment in the examination.	1.14/1/1.00	2.00/2/2.00	*0.001/0.001/0.000

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

PROGNOSIS

	Mean, mode and median prior to residency education	Mean, mode and median following residency education	Sig. Wilcoxon / McNemar
7. Prognosis- The following information should be assessed during the interview. If the resident demonstrates adequate clinical reasoning for the response, a satisfactory score will be determined.			
a. Choose assessment measures			
(49) Choose re-assessment measures to determine <i>initial</i> responses to intervention (e.g., within <u>current</u> treatment session to determine effectiveness of technique)	1.00/1/1.00	1.93/2/2.00	*0.001/0.000
(50) Choose re-assessment measures to determine <i>long-term</i> responses to intervention (e.g., correlate back to long term goals)	1.00/1/1.00	1.93/2/2.00	*0.001/0.000
b. Establish plan of care			
(51) Establish plan of care, <i>selecting</i> specific interventions based on impairments <i>Interventions must be based on the impairments noted in examination</i>	1.07/1/1.00	2.00/2/2.00	*0.000/0.000
(52) Establish plan of care, <i>prioritizing</i> specific interventions based on impairments <i>Interventions must be based on the impairments noted in examination</i>	1.00/1/1.00	2.00/2/2.00	*0.000/0.000
c. Prognosticate regarding function			
(53) Predict the <i>optimal level</i> of function that the patient will achieve	1.21/1/1.00	1.93/2/2.00	0.002/ 0.002
(54) Predict the <i>amount of time</i> needed to reach the optimal level of function	1.00/1/1.00	1.79/2/2.00	*0.001/0.001

PRACTICE DIMENSIONS EXPECTED OF ORTHOPEDIC CLINICAL SPECIALISTS

INTERVENTION

	Mean, mode and median prior to residency education	Mean, mode and median following residency education	Sig. Wilcoxon / McNemar
8. Intervention			
a. Provide patient education related to the plan of care			
(55) Educate patient on his/her <i>diagnosis</i>	1.23/1/1.00	1.57/2/2.00	0.102/ 0.219
(56) Educate patient on his/her <i>prognosis</i>	1.00/1/1.00	1.57/2/2.00	0.008/ 0.016
(57) Educate patient on his/her <i>treatment plan</i> (e.g. modalities, exercise, joint mobilization) Resident must clearly outline the treatment plan.	1.31/1/1.00	1.79/2/2.00	0.014/ 0.031
(58) Educate patient on his/her <i>responsibility or role</i> in the plan of care (home exercises, activity modification, etc.)	-	1.93/2/2.00	-
b. Implement therapeutic exercise			
(59) Implement therapeutic exercise to improve <i>mobility</i> (stretching/ self mobilization exercises). Must be consistent with exam findings.	1.08/1/1.00	1.86/2/2.00	0.002/ 0.002
(60) Implement therapeutic exercise to improve <i>muscle performance</i> (specific strengthening exercises) Must be consistent with exam findings.	1.08/1/1.00	1.64/2/2.00	0.003/ 0.004
c. Implement manual therapy procedures			
(61) Implement manual therapy procedures – <i>soft tissue mobilization</i> (Techniques must match exam findings)	1.00/1/1.00	1.71/2/2.00	0.002/ 0.002
(62) Implement manual therapy procedures – <i>Manual passive range of motion</i>	1.17/1/1.00	2.00/2/2.00	0.317/1.00
(63) Implement manual therapy procedures – <i>joint mobilization</i> (Techniques must match exam findings)	1.00/1/1.00	1.93/2/2.00	*0.000/ 0.000
(64) Implement manual therapy procedures – <i>joint manipulations</i>	-	-	-

1= unsatisfactory

2= satisfactory

Appendix E

Professional Development and Career Advancement Survey

Influence of Residency on Professional Development

Indicate level of effect

Question: How has participation in the residency program influenced your....	Extremely Positive	Somewhat Positive	No effect	Somewhat Negative	Extremely Negative	Unable to assess
Ability to perform a thorough clinical examination						
Ability to use a logical clinical reasoning process						
Ability to provide an effective treatment to achieve projected outcomes						
Ability to treat in a time efficient manner to achieve projected outcomes						
Ability to determine the nature of the patient's problem						
Ability to treat complex patients						
Ability to communicate with patients (clarity, organization, confidence)						
Ability to with other health professionals (clarity, organization, confidence)						
Ability to perform overall patient management (assess potential benefit form physiotherapy, treatment and discharge planning)						
Number of patient referrals to you?						
Number of professionals who refer patients for care to you?						
Ability to use scientific literature to provide rationale for interventions						

Influence of Residency on Career and Research Opportunities

Indicate level of effect

Question: How has participation in the residency program affected your....	Extremely positive	Somewhat positive	No effect	Somewhat negative	Extremely Negative	Unable to assess
Salary						
Promotion in the workplace						
Access to new job opportunities						
Participation in Leadership roles (work in special clinics or special committees)						
Career interest and fulfillment						
Ability to critically read and evaluate scientific literature						
Ability to obtain attain research opportunities						

How many hours of clinical mentoring did you receive in this residency program: _____

APPENDIX F

Subject Demographic Intake Form

Subject Demographic Intake Form

Subject Number: _____

Sex (Circle one): Male Female Age: _____

Physical Therapy Degree/ Diploma (Masters, Bachelors, Diploma): _____
Other Degree: _____

Years practicing as a physiotherapist: _____

Position title: _____

Current primary work setting (Inpatient, Outpatient, Home Visits, Other): _____

Primary place of employment (facility/ institution): _____

Current focus of practice:

Percent time in patient care: _____ %
Percent time teaching: _____ %
Percent time in research: _____ %

Please state the average number of patient visits for which you provide direct care (evaluation, treatment, instruction) in a typical 8 hour time period.

Type of patient visits	Number of visits in a 8 hour time period
Inpatient visits	
Outpatient visits	
Home based patient visits	
Other _____	
Other _____	
	Total Visits

Status of employment (Circle one): Full time Part Time Hourly Not employed

APPENDIX G

Graduating Resident Interview Guide

Barriers and Facilitators for participation in the residency

Could you describe your experience in the residency program?

What barriers did you encounter when considering participation in the residency program?
What made it difficult for you to participate?

How were you assisted to complete the residency?
What type of support network did you have at home or work that facilitated completion of the program?

Barriers and facilitators to integration of new knowledge in the clinic

Could you describe your experience integrating the knowledge and skills gained through the residency into clinical practice?

What barriers did you encounter when integrating information gained through the residency into clinical practice?

What assisted you in integrating information gained through the residency into clinical practice?

Clinical reasoning in general

What do you think clinical reasoning means? How would you describe clinical reasoning?

Tell me about what factors or activities assisted you in developing clinical reasoning skills?
.... May prompt with clinical experience or mentorship.

How have these thought processes evolved through the residency experience?

Regarding live patient practical exam session

What were your feelings about the live patient practical examination?

What process do you use when making a clinical decision about a patient?

How did you employ these processes during the practical experience?
How would you describe your clinical reasoning process?
Can you tell me step by step how you_____?

How does the process you used during the practical exam compare to what a typical treatment session involves in your facility?

If not a typical treatment session, what was different about this treatment?

How did the residency program change the way you develop and implement your treatment plan in the clinical setting?

Closure

Is there anything else you would like to discuss before we end this interview?

Appendix H

Documentation of Informed Consent

Graduating Residents

RADFORD UNIVERSITY

Documentation of Informed Consent Graduating Residents

Title of Research: Development of clinical reasoning skills and career advancement in graduates of a post-graduate physiotherapy residency program in Nairobi, Kenya: A mixed methods study

Funding Source: None

IRB Protocol Numbers: _____

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If you have questions or concerns about your rights as a research subject or have complaints about this study, you should contact Dr. Dennis Grady, Dean, College of Graduate and Professional Studies, Radford University, dgrady4@radford.edu, +1-540-831-7163.

Data Collection will occur at KMTC, Nairobi in the Department of Physiotherapy.

What is the study about?

We ask you to be in a research study that will describe the outcome of a post-graduate orthopaedic manual therapy residency program on development of knowledge and clinical reasoning by physiotherapists in Nairobi, Kenya. Study will also explore the effect of the residency program on the participants' clinical practice and career advancement. This part of the study will explore your thoughts about (a) barriers and/or facilitators that affected your participation in the residency program, (b) the residency program's ability to foster the use of new skills in the clinical environment, and (c) barriers and/or facilitators to integrating concepts and skills gained during the residency program into your clinical practice.

Why are you asking me?

You are being asked to participate as a resident in the Orthopaedic Manual Therapy Residency program in Nairobi, Kenya.

What will I be doing if I agree to be in the study?

If you choose to be in the study, you will be asked to:

- 1) allow the investigators access to your completed final live practical examination assessment forms.
- 2) complete a survey requesting demographic information and information regarding the influence of the residency program on your professional development and career.
- 3) participate in a one on one interview to discuss barriers and/or facilitators for participation in the residency program and for implementation of new skills in the clinical environment

If you decide to be in this study, you may choose not to answer certain questions or not to be involved in parts of this study. You may also choose to stop being in this study at any time without any penalty to you.

Participation in the study will not affect your final practical examination assessment findings.

The estimated time for completion of the survey and interview is approximately 50 minutes.

What are the dangers to me?

This study has no more risk than you may find in daily life. See comments on other consent form

Are there any benefits for taking part in this research study?

If you decide to be in this study you may not directly benefit from being a part of it.

Will it cost me anything?

There are no costs to you for being in this study. There is no payment for you taking part in this study.

How will you keep my information private?

If you decide to be in this study, what you tell us will be kept private. You will be assigned a subject number that will be used to identify you on all data collected. All information collected will be stored in a locked cabinet in a locked office at Radford University in the Department of Physical Therapy. The information collected will be maintained for a period of six years. All information obtained in the study is strictly confidential unless law requires disclosure.

We will present the results of this study, but your name will not be linked in any way to what we present.

What do I do if I want to leave the study?

You can choose NOT to be in this study. You will still complete the final live patient practical examination as a requirement for completion of the residency program.

If you decide to be in this study, you may choose to stop being in this study at any time without any penalty to you. Participation in this study does not affect your good standing in the residency program.

Is there any audio or video recording?

This study will include audio recording of the individual interviews regarding barriers for participation in the residency program and for implementation of new skills in the clinical environment. The audio recording will be available to be heard by the researcher and the research committee members listed above. The recording will be transcribed by the primary investigator, Shala Cunningham. The recording will be kept securely in the physical therapy department at Radford University in a locked cabinet in a locked office. The recording will be destroyed immediately following transcription. Because your voice may be potentially identifiable by anyone who hears the recording, your confidentiality for things you say on the recording cannot be guaranteed although the researcher will try to limit access to the tape as described in this paragraph. Your name and identification number will not be used during the interview.

What if I have questions about the study?

If you have questions now about this study, ask before you sign this form.

If you have any questions later, you may talk with Shala Cunningham . She will be onsite during data collection and available by email following the examinations. Her email address is listed above.

This study was approved by the Kenya Medical College Ethics and Research Committee, the Radford University Committee for the Review of Human Subjects Research and the Institutional Review Board at Nova Southeastern University.

Being in this study is your choice and choosing whether or not to take part in this study will not affect any current or future relationship with KMTC, Radford University, or Nova Southeastern University.

By signing below, you indicate that:

- this study has been explained to you
- you have read this document or it has been read to you
- your questions about this research study have been answered
- you have been told that you may ask the researchers any study contact them in the event of a research-related injury
- you have been told that you may ask Institutional Review Board (IRB) personnel questions about your study rights
- you are entitled to a copy of this form after you have read and signed it
- you voluntarily agree to participate in the study entitled: Development of clinical reasoning skills and career advancement in graduates of a post-graduate physiotherapy residency program in Nairobi, Kenya: A mixed methods study

Date

Signature

I have explained the study to the person signing above, have allowed them an opportunity for questions, and have answered all of his/her questions. I believe that the subject understands this information.

Signature of Researcher

Date

Note: A signed copy of this form will be given to the subject for the subject's records.

Appendix I
Documentation of Informed Consent
Patients

Informed Consent for Patient Examination by a Physiotherapy Residency Participant

Description: You will be having an examination performed by a resident in the Advanced Diploma in Orthopaedic Manual Physical Therapy program at Kenya Medical Training College (KMTC). All residents are licensed physiotherapists. There will be an additional individual in the room. This individual will be assessing the resident's performance during the examination.

Procedures: If you agree to participate in this examination, please sign and date this consent form. The physical therapist providing your care will request consent with each examination procedure.

Risk: There is no additional risk or potential for harm beyond that normally experienced with physiotherapy examinations. The treatment program by your attending physiotherapist at KMTC will not be altered as a result of participation in this project. In the event that you experience any increased discomfort during the examination, please relay this information to the examining physiotherapist.

Benefits: There will be no direct benefit to you as a result of participation. You will receive satisfaction by participating in the enhancement of knowledge among physiotherapists in the residency program. You may relay any information given to you by the resident to your attending physiotherapist at KMTC for incorporation into your physiotherapy treatment program.

Cost: There is not cost to you for participation in this examination.

Confidentiality: Your name will not be identified with the examination documentation as to protect your individual identity and protected health information.

Participation/Withdrawal: Your participation in this examination is voluntary and you may withdraw at any time. You may refuse to participate in any of the examination procedures.

Contact Information: If you have questions now about this examination, ask before you sign this form.

If you have any questions later, you may talk with Shala Cunningham. She will be onsite during the examinations. You may also direct questions about the project to the residency instructors in the treatment room.

Patient Name (Print)

Patient Signature

Instructor Signature

Date

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