

**INTERRELATIONSHIPS AMONG ACADEMIC, CLINICAL
PLACEMENT AND LICENSING EXAMINATION SCORES OF UWO
PHYSICAL THERAPY GRADUATES**

by

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ABSTRACT

The extent to which academic and clinical performance of graduates of the School of Physical Therapy (PT) at The University of Western Ontario (UWO) relate to each other and to performance on the Physiotherapy National Examination (PNE) is unclear. However, this information is essential to assist in curriculum revision and to ensure that the program is preparing graduates to succeed on the PNE. Graduates of the 1996 ($n = 60$) and 1997 ($n = 61$) UWO PT classes were contacted by mail and asked to consent for involvement in the present study and use of information from their academic files, provide a copy of their notification of PNE scores and respond to a short questionnaire. For the 78 respondents who took the PNE in the year following graduation, the correlations between the academic GPA, *and* seven of eight of the correlations for the final two Clinical Placement scores ranged from $r = 0.23$ to 0.33 , ($p < 0.05$) and were similar to the correlation between the written (MCQ) *and* clinical (OSCE) components of the PNE ($r = 0.26$, $p < 0.05$). Also, the academic GPAs correlated better with the MCQ component of the PNE ($r = 0.38$ to 0.57 , $p < 0.01$), and the Clinical Placement scores correlated better with the OSCE component of the PNE ($r = 0.29$ to 0.36 , $p < 0.01$). These results suggest that the academic GPA and the MCQ test similar aspects of clinical competency related to knowledge, and that the Clinical Placement scores and the OSCE test similar aspects of clinical competency that are related to clinical reasoning and skills performance. Future research should examine these relationships in other PT programs.

DEDICATION

I would like to dedicate this work to my late grandmother (Sitty Missadi), who was a major influence in my life. I would also like to dedicate this to my parents, who have always instilled in me the importance of education and have encouraged me to always pursue my dreams.

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CHAPTER 1

INTRODUCTION

In Canada, physical therapy (PT) curricula are based on guidelines prepared by the Council of Directors of Physical Therapy Academic Programs (CDPAP) and the Canadian Physiotherapy Association (CPA). This document (Entry-Level Curriculum for Canadian Physical Therapy Programs-Guidelines for Faculty, June 1995) describes the knowledge, skills and professional behaviours thought to prepare PT students for entry-level competence upon graduation. Since this document serves only as a guideline to achieving educational goals and not as a blueprint for educational programs, the course content, methods of presentation, and methods of evaluating knowledge and clinical skills may differ among PT programs based on their unique interpretations of the guidelines, faculty complement, university situations and geographical areas.

The educational experiences of PT students across Canada may differ greatly depending on variations in teaching and presentation styles, the specialties represented in different PT programs and variations in clinical placements. One requirement to licensure in several provinces (British Columbia, Alberta, Ontario and Prince Edward Island) is that PT graduates must successfully complete on the Physiotherapy National Examination (PNE).

UWO PT Curriculum Outline

In 1996 and 1997, the Physical Therapy program at The University of Western Ontario (UWO) included six terms and seven clinical placements over a three year period. The course content in the first two years included basic science and PT courses. In the final

year of the program, there were three required PT courses and a special project course, which may be a literature review or a research study, as well as a minimum of three to four elective PT courses (Table 1).

Table 1: Topical Areas for Courses in the Physical Therapy Curriculum at The University of Western Ontario for 1996 and 1997.

	PT Courses	External Courses
Year 1	1. Therapeutic Exercise 2. Musculoskeletal Exercise 3. Soft Tissue mobilization 4. Human Development 5. Electrotherapy 6. Research methods	1. Pathology 2. Physiology 3. Gross Anatomy 4. Neuroanatomy
Year 2	1. Introduction to Clinical Issues 2. PT in Orthopaedics 3. PT in Neurology 4. PT in Rheumatology 5. Peripheral Vascular Disease, Burns and Amputees 6. PT in Cardiorespirology 7. Medicine and Surgery	1. Exercise Physiology 2. Neurophysiology
Year 3	1. Biomechanics 2. Administration 3. Advanced Topics in Psychiatry and Pharmacology 4. Special Project 5. Sports Medicine* 6. Geriatrics* 7. Occupational Health* 8. Advanced Orthopaedics*	

*** Elective Courses**

Clinical placements were completed at the end of each year of the program. A three-week introductory placement was completed after the first year of the program, three five-week placements were completed after the second year and three five-week placements were completed during the second half of the final year of the program.

Although the curriculum is reviewed and modified yearly, the extent to which classroom and clinical placement courses in the PT program are related to one another, and to performance on the PNE is unclear. However, this information is important in curriculum revision and to ensure that the program is preparing graduates for entry level practice and for successful completion of the PNE. It is unclear whether academic achievement and clinical placement scores in PT programs correlate highly with each other, or with post-graduate clinical performance. Because the vast majority of the UWO graduates take the PNE either to practice in Canada, or to qualify for a state licensing examination in the USA, knowledge of how well the UWO PT program prepares graduates for the PNE can have curriculum implications.

Physiotherapy National Examination (PNE)

The Canadian Alliance of Physiotherapy Regulators (the Alliance), formerly the Alliance of Physiotherapy Regulatory Boards, was formed in 1985. The existing provincial regulatory boards joined together under the Alliance to establish an entry-level practice standard to meet the needs of self-regulation and public protection. In 1986, the Alliance appointed a committee to investigate methods to establish an entry-level practice standard and to develop a licensing examination. A written, multiple choice question (MCQ) examination was approved in 1988, and piloted in 1992. It was deemed necessary by the Alliance to use more than one method of testing in “high-stakes” examinations such as those scored as pass-fail or for licensure. Subsequently, the Objective Structured Clinical Examination (OSCE) was approved as the test for the clinical component of the Physiotherapy National Examination (PNE) and was pilot tested in 1992. The OSCE

format is a method of standardizing the evaluation of clinical skills performance in a test situation, where students are tested at several stations, moving from station to station (each 5-10 minutes in length) and are required to perform various clinical tasks on standardized patients, and are marked with the aid of a checklist (Harden et al 1975). Physical Therapy graduates must successfully pass both components of the PNE to receive a license to practice in British Columbia, Alberta, Ontario and Prince Edward Island. Another province (New Brunswick) has made legislative changes, but has yet to implement the requirement to pass the PNE.

In 1992, the pilot test of the MCQ component of the PNE revealed a high degree of internal consistency (0.86) utilizing the KR-20 statistic (Skakun 1992). According to the consultant's report, this value was comparable to that reported for a similar licensing exam in Occupational Therapy. Content validity was examined through the Test Construction Sub-Committee whose members traced all test items in the question bank to their knowledge, function, and specialty dimensions in the domain of Physical Therapy. Construct validity was also demonstrated through testing of students in all levels in PT programs. The mean test score increased significantly from Year 1 to Year 4, indicating that the test was able to distinguish between the levels of education (Skakun 1992).

The pilot test of the OSCE was conducted by the National Examination Committee, where both English and French versions of a 20 station OSCE were administered to volunteer final year physiotherapy students (not graduates) from 13 Canadian physiotherapy programs on March 7, 1992. Rothman and Cohen (1992) reported that the mean (SD) scores of the English and French pilot tests were 57.6% (4.76) and 52.6%

(5.45) respectively, and the overall mean was 55.3% (5.64). Reliability estimates of the pilot test were $r = 0.62$ for the Toronto (English) site and $r = 0.72$ for the Quebec (French) site, with an overall reliability coefficient of $r = 0.70$. These results were considered to fall within the recommended standard of reliability of between 0.60 and 0.80 for an OSCE (van der Vleuten and Swanson 1991).

The validity coefficients, reported as Pearson r 's, for each OSCE station ranged from $r = 0.14$ to 0.52 for the Toronto site, and $r = 0.14$ to 0.64 for the Quebec site, and $r = 0.05$ to 0.63 for the two sites combined. According to the consultants' report, the magnitude of the validity coefficients was consistent with those previously observed with this testing model and was considered satisfactory (Rothman and Cohen 1992).

Given satisfactory psychometric properties of the pilot administration of the clinical skills examination, a 20 station OSCE was implemented as the clinical skills component of the PNE in June 1996. The first two years of implementation of the OSCE in 1996 and 1997 were also characterized by high reliability ($r = 0.86$ and 0.89) (Operational Issues and Implications of a Shortened, Staged Exam-Canadian Alliance of Physiotherapy Regulators, November 1998).

Literature Review

The relationship between academic and clinical performance within PT programs has been examined in several studies (Tidd and Conine 1974, Pickles 1977, Rheault and Shafernich-Coulson 1988, Levine et al 1986, Balogun et al 1986). In addition, predictors of academic and clinical performance in PT programs (Olney 1977, Peat et al 1982, Levine et al 1986, Balogun et al 1986, Balogun 1988, Day 1986, Payton 1997),

and licensing examination scores (Roehrig 1988, Gross 1989), have been studied as a means to select students for admission to PT programs.

Theoretically, students who have better knowledge should perform better clinically. Also, students with greater knowledge and better clinical performance in a PT program should score higher on licensing examinations after graduation. However, there is no universal agreement on how to evaluate the various components of knowledge and clinical skills performance. In medicine, interpersonal skills, humanistic qualities, technical skills, and overall professionalism have been suggested to be other important contributors to clinical performance, aside from medical knowledge (Ramsey 1997). These qualities are difficult to measure by written examinations and, to date, have not been examined extensively in the PT literature.

Academic and clinical records of 285 Indiana University physical therapy graduates between 1960 and 1972 were utilized by Tidd and Conine (1974) to study the relationship between clinical performance and academic achievement. The correlations between the total college GPA (excluding the clinical grades) and the sub-GPA for the clinical practicums, the pre-professional GPA, GPA of PT courses, biological and physical science courses, and behavioural science courses varied widely. The correlation between the total college academic GPA and the clinical GPA was $r = 0.39$, ($p < 0.01$). The correlation between the GPA in PT courses and the clinical GPA was higher ($r = 0.43$, $p < 0.01$). However the correlations between the clinical GPA and the GPA of the biological and physical science courses were $r = 0.28$, ($p < 0.01$) and the GPA of the behavioural science courses was $r = 0.23$, ($p < 0.01$).

These results (Tidd and Conine 1974) were similar to those reported in another study that compared clinical placement scores to other measures of academic achievement (Olney 1977). Aggregate scores of the last six clinical clerkships of advanced clinical course work, each of six weeks duration, and the Year 3 GPA of PT graduates from the School of Rehabilitation at Queen's University were used as estimates of proficiency at a time close to entry to practice. The correlation between the aggregate clinical clerkship scores and the Year 3 GPA was $r = 0.37$, ($p < 0.05$). There was a higher correlation between the clinical clerkship aggregate score and the electrotherapy and manipulations course score ($r = 0.46$, $p < 0.05$), which was part of the third year curriculum. However, the correlation between the clinical clerkship score and the GPAs in the biological and behavioural science courses (taken throughout the program) were lower and varied from $r = 0.04$ to 0.24 , ($r = 0.24$ significant at 0.05 level, otherwise $p > 0.05$).

Pickles (1977) examined the relationship between the clinical placement GPA and the total university GPA for each year of the three year PT program at the University of Alberta in 1975 and 1976. His findings were rather unique in that the correlation between the yearly GPA and clinical placement scores varied much more than reported in the previous two studies (Tidd and Conine 1974, Olney 1977); Year 2: $r = 0.29$, ($p > 0.05$) for 1975 and $r = 0.74$, ($p < 0.05$) for 1976, Year 3: $r = 0.91$, ($p < 0.05$) for 1975 and $r = 0.37$, ($p > 0.05$) for 1976. The correlation between the GPA of all PT courses and clinical placement scores also varied widely for Year 2 ($r = 0.02$, $p > 0.05$ and $r = 0.65$, $p < 0.05$) and Year 3 ($r = 0.89$, $p < 0.05$ and $r = 0.40$, $p > 0.05$) in 1975 and 1976, respectively. Although neither the curriculum nor the course instructors for the second

and third year of the program had changed during the period of the study, the large variation in results that existed for the 1975 and 1976 classes were either attributed to real differences between classes or due to the limitations of the sample in being representative of the class. Only 15 of 33 and 10 of 33 year 2 students volunteered for the study in 1975, and 8 of 31 and 14 of 33 students volunteered for the study in 1976 (Pickles 1977). This suggests that there can be year to year variations in class scores, and that combining the years may result in correlation coefficients that are closer to the true score.

One of the consistent characteristics among all three studies cited above was that the reliability and validity of the tools used to measure clinical achievement were not investigated. Similarly, in a study by Rehault and Shafernich-Coulson (1988), the GPA based on all courses in the two year program was compared to clinical performance, determined from the Illinois Consortium for Clinical Education's Physical Therapy Student Performance Report. Although this tool was not formally evaluated in terms of its psychometric characteristics, clinicians and educators considered this form to be a reliable and valid tool for assessing clinical performance. The results of this study differed considerably from the previous three studies (Tidd and Conine 1974, Olney 1977, Pickles 1977). A very low negative correlation was found between GPA and clinical performance scores ($r = -0.09$, $p > 0.05$).

In general, these studies suggest that there is a low to moderate relationship between academic GPAs and clinical placement scores, and that the relationship between PT courses and clinical placements scores tend to be higher. These results may vary according to the data that were used to calculate the academic GPA and the tool used to

evaluate clinical placements.

Rhealt and Shafernich-Coulson (1988), and Tidd and Conine (1974) calculated the academic scores using all the courses taken in a two year PT program. Pickles (1977) examined each academic year of a three year program individually, and Olney (1977) used the overall average of courses taken in the final year of the PT program. Other sources of variation include the lack of a reliable and valid tool for determining a clinical placement score, as well as performance of clinical skills as part of the course work in PT programs.

Assessment of Clinical Competence

Loomis (1985a) developed one of the first widely used tools to evaluate the knowledge, clinical skills, judgment, and attitudes considered necessary to effectively practice as a physiotherapist, which could be used to evaluate students' performance during clinical placements. The Evaluation of Clinical Competence (ECC) is a criterion-referenced evaluation tool which uses a four point behaviourally-anchored rating scale to score the extent to which a physical therapy student could perform clinical competencies required for entry into the profession.

The reliability estimate of the ECC, determined through the interclass coefficients for the total scale score and the seven sub-scale scores, was $r = 0.62$ for the third year clinical placement and $r = 0.59$ for the fourth year clinical placement (Loomis 1985b). Content validity was based on careful planning in the development phase to ensure that the competencies listed actually represented the domain of PT at that time, as determined by a panel of expert clinicians. A high degree of concurrent validity was suggested by the correlation (Spearman rho) between the ECC and employment ratings ($r = 0.52$, $p < 0.01$

and $r = 0.68$, $p < 0.01$), as well as a high degree of construct validity, indicated by the fact that Year 4 students performed significantly better on the ECC than did the Year 3 students ($p < 0.01$). The investigator suggested that the ECC was a reliable, valid and practical instrument that could be used to assess clinical competence in clinical placements (Loomis 1985b). Currently, about three Canadian PT programs use the Loomis ECC form and the remaining programs use a variety of other clinical evaluation forms. Although clinical skills performance of PT students is assessed by the supervising therapists in clinical placements, PT programs also test the clinical abilities of their students in clinical courses, before they go on to clinical placements.

The OSCE format is a structured approach of evaluating clinical competency that examines a wide range of factual knowledge, clinical skills, and problem solving abilities of a large number of students in a short period of time (Harden et al 1975). It was developed in response to medical examiners' concerns that the existing format of clinical examination was too "subjective" due to variation in marking standards, limitations of the small number of patients on which students were examined, and confusion about what was being tested in the conventional clinical examination (Harden et al 1975).

Although the OSCE format has been reported to be reliable and valid (Harden et al 1979, Newble and Swanson 1988, van der Vleuten et al 1991, Reznick et al 1992) and has been frequently used by the medical community to assess medical clerks (Petrusa et al 1987, Williams et al 1987, Newble and Swanson 1988, Matsell et al 1991, Hull et al 1995), fourth year medical students (Coovadia and Moosa 1985, Famuyiwa et al 1991), medical residents' performance (Anastakis et al 1991, Cohn et al 1990, Dupras and Li

1995), as well as eligibility for licensure (Reznick et al 1997), the OSCE has been less used in physiotherapy programs (Nayer 1993). Typically, the performance of clinical skills of physiotherapy students is not evaluated with an OSCE at the end of their clinical placement. In physiotherapy placements, supervising therapists evaluate students by observation of their clinical skills and use a clinical evaluation form. To date, little work has been done to evaluate the reliability and validity of therapists' evaluations and clinical evaluation forms (Loomis 1985- a and b).

Nayer (1995) used a questionnaire to collect information on the methods used by PT programs to assess knowledge and clinical skills. She found that the use of the OSCE was quite limited, with only two of the 11 respondent universities (13 universities contacted) using the OSCE format as their only means of assessing clinical performance in their PT programs. Five of the 11 PT schools used formats that were similar to an OSCE, however nine of the 11 PT programs used other methods of evaluating clinical skills or practical examinations, which included the following: 1) students questioned using cases, 2) students questioned without cases, 3) pre-structured standardized oral exams, and 4) simulated patients (SP).

These clinical examinations varied in length between ten and 45 minutes, but were typically 20 minutes long. Usually, the non OSCE examination was only one station in length, although two schools reported using two to four stations. The students were evaluated by the course instructor or other faculty. According to Nayer (1995), two schools were planning to implement the OSCE in the future. Currently, there is a void of information relating to the perceived usefulness of the OSCE in physiotherapy programs.

Graduates of most PT programs may not be familiar with large-scale OSCEs (Geddes and Crowe 1998) and may be adversely affected when their first exposure is a “high-stakes” pass-fail licensing examination like the PNE.

Geddes and Crowe (1998) developed a peer-rated OSCE to allow students the opportunity to become familiar with an evaluative OSCE and receive a formative evaluation of the academic cardiorespirology unit of the McMaster University physiotherapy program. Students were allowed an equal opportunity to engage in all three roles: the student, the patient, and the examiner. The students strongly indicated support for the peer-rated OSCE as an effective tool in familiarizing them with the OSCE format as well as the course content. Students appeared to learn the most in the roles of the student and the examiner, while learning the least as the standardized patient.

The peer-rated OSCE was also found to be cost effective and time efficient to organize and administer, given the benefit of enhanced learning, formative evaluation and increased familiarity with the OSCE format (Geddes and Crowe 1998). These benefits are important because the OSCE could be used more frequently by PT programs to assess clinical competency, especially since the OSCE has been adopted as the clinical component of the PNE by the Alliance.

The use of a cardiorespirology theme Objective Structured Practical Examination (OSPE) for assessment of clinical competency in an academic environment was examined by Davis and Hill (1997- a and b). Their purpose was to determine if the 1993/94 OSPE was a valid means of assessing physiotherapy skills of first year students prior to students undertaking the clinical education placement in the second year of the program. Evidence

of content validity was sought during the development phase by aligning the content of the cardiorespirology course with the knowledge and skills which the clinical educators expected the students to demonstrate during their first placement.

The content validity of the OSPE was also assessed by a questionnaire given to three different groups of stakeholders: the students, the physiotherapy academic staff and the clinical educators (Davis and Hill 1997a). They were asked to 1) identify which, if any, of the course objectives were measured by the test items listed, 2) rate (on a 5 point scale) how closely they felt that each test item represented the course content, and 3) rate how closely each test item reflected the skills used in contemporary clinical practice.

Though this OSPE was regarded as highly representative of the course content and objectives, the clinical educators still felt the need to verify the students' skill and safety by direct observation in a "real" clinical setting. The OSPE was considered useful in determining the students' competence and influencing how the students were introduced into clinical practice, and determining if concerns of the clinical educators would have any foundation (Davis and Hill 1997b).

The criterion-related validity of the 1993/94 cardiopulmonary theme, eight station OSPE was also examined (Davis and Hill 1997b). The students' scores on the OSPE were compared to their written examination marks and their Year 2 Clinical Education Assessment. Low correlations were noted between the OSPE and the written examination ($r = 0.24$, $p > 0.05$), as well as the overall clinical education assessment ($r = 0.39$, $p < 0.01$). However, when considering the practical skills component of the clinical education assessment and its correlation with the OSPE, a moderate relationship was

observed ($r = 0.46$, $p < 0.01$). Also, a lower correlation was noted between the written exam and the practical skills component of the clinical education assessment ($r = 0.35$, $p < 0.05$). The authors concluded that there was little evidence for concurrent criterion-related validity between students' scores on the 1993/94 cardiorespiratory OSPE and the written examination. However, criterion-related predictive validity was inferred by the OSPE for performance on the practical skills component of the clinical assessment (Davis and Hill 1997b).

One weakness of this study, expressed by the authors, was the fact that the clinical assessment form was not validated for its suitability as a criterion with which to compare other assessment measures (Davis and Hill 1997b). Therefore, the clinical assessment form that was developed for this new physiotherapy program should not have been used as the criterion measure or the "gold-standard" to compare to the OSPE. The low correlation in this study between the OSPE and the written examination was attributed to the fact that these examinations tested different aspects of competency (Davis and Hill 1997b). The written examination tested factual knowledge whereas the OSPE tested practical or clinical skills. However, moderate correlations could be explained by the fact that the acquisition and application of practical skills also required the recall of knowledge.

Reports of moderate correlations were also evident in studies examining the OSCE in relation to traditional methods of testing in medical programs (Coovadia and Moosa 1985, Famuyiwa et al 1991, Matsell et al 1991, Williams et al 1987). Coovadia and Moosa (1985) evaluated the validity of a 14 station OSCE, in relation to a Multiple Choice Question (MCQ) Examination and the Clinical Evaluation of seven groups of fifth year

medical students. Correlations of $r = 0.40$ to 0.41 , ($p < 0.05$) were reported between the OSCE and Clinical Evaluations in only three of seven groups and low correlations ($r = 0.21$ to 0.35 , $p > 0.05$) were reported for the other four groups of students. The correlations reported between the OSCE and the MCQ were moderate ($r = 0.59$ and 0.56 , $p < 0.01$) in two groups, low in three groups ($r = 0.32$ to 0.39 , $p > 0.05$) and slight in two of seven groups ($r = 0.06$ and 0.13 , $p > 0.05$).

The inconsistent correlations between the OSCE and all three components of the traditional exam were explained by the fact that the OSCE tested different aspects of clinical competency and therefore rendered direct comparisons between the OSCE and traditional methods of testing difficult, given the divergent findings (Coovadia and Moosa 1985). Therefore, the OSCE was recognized by the authors to assess different, but related, functions of clinical competency and theoretical knowledge. Although the OSCE was integrated into the assessment of fifth year medical students, it was acknowledged to complement, but not replace, conventional tests.

Famuyiwa et al (1991) examined the use of a 20 station OSCE for assessing undergraduate psychiatry students in relation to the traditional methods of examination, such as the In-Course Assessment (ICA) consisting of a 20-stemmed multiple choice question (MCQ) paper of the true/false response type, and the Traditional Long-case Clinical examination (TLC) consisting of two theory papers (200 question MCQ with 40 stems and an essay exam paper). They reported a high correlation between MCQ marks and the OSCE marks for the 1987 class ($r = 0.68$, $p < 0.05$), although a lower correlation was reported for the 1988 class ($r = 0.57$, $p > 0.05$).

Similar results were noted in a study that evaluated the use of the OSCE as an examination tool in a paediatric clinical clerkship (Matsell et al 1991). In order to evaluate its construct validity, they divided the OSCE into various components of clinical competence. Clinical skills, problem solving, knowledge and management components as well as the total score of the OSCE were correlated with the corresponding areas of the standard evaluation procedure. The standard procedure included an Observed Clinical Skills (Bedside Oral Examination) score, a Written Problem Solving (10 written problem solving exercises) score and a Knowledge (interim and final MCQ) score. In this setting, moderate to high correlations were found between the total OSCE scores and the overall standard assessment ($r = 0.79$, $p < 0.01$), as well as most of the components of the standard evaluations, including problem solving ($r = 0.63$, $p < 0.01$), interim MCQ ($r = 0.64$, $p < 0.01$), final MCQ ($r = 0.65$, $p < 0.01$), and faculty ward evaluation ($r = 0.54$, $p < 0.01$). The authors concluded that this OSCE was a useful means of identifying strengths and weaknesses in specific areas of clinical competence, and that it was an accurate measure of knowledge and patient management skills.

The evaluation of a Direct Standardized Assessment of clinical competence, resembling an OSCE, that was developed for medical clerks was compared to traditional methods of evaluating clinical skills (Williams et al 1987). The assessment of clerks was typically based on subjective ratings of clinical performance. As a result, residency directors placed greater faith in the multiple choice test scores of the National Board of Medical Examiners (NBME)-Part I in selecting new residents, even though they recognized that these tests only measured one dimension of clinical competence (knowledge base). The

comprehensive clinical examination was administered after all clerkships were completed and used as a final check on the clinical competence of students and their readiness for postgraduate education. The intent was to use this tool to complement traditional ratings. However, after pilot testing, this clinical comprehensive examination became a graduation requirement.

The correlation between the Clinical Case Exam and the combined score on a number of independent measures of clinical competence assessed by teachers in various disciplines was $r = 0.65$, ($p < 0.01$). The correlations between the comprehensive Clinical Case Exam and the NBME Part I Exam ($r = 0.53$, $p < 0.01$) and Part II ($r = 0.51$, $p < 0.01$) were lower. This standardized clinical examination was found to minimize the disadvantages associated with using the teachers' ratings alone as an estimate of clinical performance. The authors suggested that an exam of this type may add another dimension to studies validating certification examinations (Williams et al 1987).

The prediction of performance on licensing examinations is important to medical and physiotherapy programs when considering admission criteria, as well as curriculum reform. Roehrig (1988) reported that pre-admission data, such as the American College Testing composite and four sub-scale scores, prerequisite and non-prerequisite GPAs, and scores from pre-admission letters, all contributed significantly to the state licensing examination scores ($r = 0.24$ to 0.52 , $p < 0.05$). However, interview scores and recommendation letters were not found to contribute. Academic and clinical scores within the PT program were not included in the study.

In a study by Gross (1989), pre-professional academic performance and general verbal

and mathematics aptitude were moderate predictors of professional didactic performance. However, these variables were less valuable in predicting licensure performance and were poorly correlated with clinical performance.

Few studies have attempted to clarify whether high scores in academic achievement and clinical placements in PT programs correlate highly with each other or post-graduate clinical performance, or performance on professional licensing examinations. The recent implementation of the PNE in Canada, as a means to assess minimum entry-level competency of graduating physiotherapists, leads to the question of how performance in physiotherapy programs relates to performance on the written (MCQ) and clinical (OSCE) components of the PNE.

Purpose

The purpose of the present study was to determine the relationships among academic and clinical placement scores within the program, and between these scores and those on the PNE for the 1996 and 1997 graduates of the UWO Physical Therapy program.

CHAPTER 2

METHOD

Subjects

The names and mailing addresses of all 1996 (n=60) and 1997 (n=61) UWO Physical Therapy graduates were obtained from the student files at the School of Physical Therapy. A letter of information and a consent form (Appendix A) were sent to each graduate. Graduates were requested to allow the investigators access to their academic files containing their grades and clinical evaluation forms. They were also asked to complete a one page questionnaire (Appendix B) and to send a photocopy of the notification of their PNE scores to the investigators. Graduates who were unable to locate their notification of PNE scores were asked to indicate in writing on the consent form that they agreed to allow the investigators to request their PNE scores directly from the Canadian Alliance of Physiotherapy Regulators.

Follow-up telephone calls were made to graduates who did not respond after four weeks to ensure that they had received their letter of information, and duplicate packages were sent to current addresses as necessary. Graduates who had not responded and were unable to be contacted by telephone were considered as “unable to locate”. Graduates who consented to allow the investigators access to their academic records and completed the PNE in 1996 or 1997 were included in the study. Graduates were excluded from this study if they had not taken the PNE within a year of graduation. Only the results of their first attempt of the PNE were used. If a graduate was unsuccessful in their initial challenge of the PNE, the results from the second attempt were not used.

Sample Size

The number of physical therapy graduates in 1996 and 1997 was 121 in total. A response rate of 50% was considered realistic, giving a probable final sample size of about 60 respondents. A sample size of 60 was considered adequate to declare an observed $r = 0.35$ to be statistically significant, with an $\alpha = 0.05$ and $\beta = 0.20$ (Hulley and Cummings 1988).

Procedures

The present study was approved by the Ethics Committee at The University of Western Ontario (Review No. E6227). The academic and clinical information that was obtained from the students' files, along with the biographical and PNE information received from the graduates were entered into a single data file. The variables used in this study are listed in Table 2. Operational definitions and abbreviations for the variables used are summarized in the Glossary of Terms (Appendix C). The MCQ and OSCE components of the PNE were reported as standardized scores, while GPAs were reported as a percent.

Clinical placements of five weeks duration were completed after the second (Intermediate) year in the program (PT 382-clinical placements 2, 3, and 4) and the third (Senior) year in the program (PT 482-clinical placements 5, 6 and 7). Performance in clinical placements of the 1996 and 1997 UWO graduates was assessed by supervising physical therapists using the clinical evaluation form (Evaluation of Clinical Competency-ECC) developed by Loomis (1985). Each clinical evaluation form was given a total weighted score using a system that was developed by the Clinical Experience Committee (CEC) of the School of Physical Therapy at the UWO (Appendix D). The weighted score

was determined by allocating a weighted value to each of the criterion-referenced scores (0 to 4) used to evaluate the 36 sub-competencies within the seven major areas of competency, and then calculating their sum. In cases where a zero score was given, indicating that the performance was not observed on a sub-competency, the minimum passing score was entered in order to produce a weighted total score based on 36 items. In the case of a failed clinical placement, the remedial placement score was used, since it was a requirement for successful completion and graduation from the UWO program.

Table 2: List of Variables*

PNE	ACADEMIC	CLINICAL	BIOGRAPHICAL
1. MCQ Score	1. GPA year 1	1. Placement 2	1. Age
2. OSCE Score	2. GPA year 2	2. Placement 3	2. Sex
3. Total PNE	3. GPA year 3	3. Placement 4	3. Years PSSE
	4. Mean GPA	4. Placement 5	4. Weeks of Practice
		5. Placement 6	5. Admission Average (GPA)
		6. Placement 7	
		7. PT 382	
		8. PT 482	
		9. Mean Clinical Score	

* Appendix C: Glossary of Terms provides information on how these scores were calculated and operational definitions.

Data Analysis

Information from the 1996 and 1997 classes was combined for analysis. Independent t- tests (two tailed) were used to determine if the age, Mean Academic GPA and the Mean Clinical Placement scores of the 1996 respondents differed from those of the 1997 respondents, and if the respondents' Mean Academic GPA differed from that of the 1996 and 1997 graduating class as a whole (SPSS v.7.5. 1996). Pearson Product Moment Correlation coefficients (r) were used to determine the relationship among variables. For $n = 78$, the following critical values for r were used (degrees of freedom = $n - 2$) $p = 0.05$, $r = 0.22$ and $p = 0.01$, $r = 0.29$ (Weber and Lamb 1971). Emphasis was placed on the magnitude of the correlation, rather than its probability level. Correlations were interpreted according to the criterion suggested by Weber and Lamb (1971): $r < 0.19$ - slight; $r = 0.20$ to 0.39 - low; $r = 0.40$ to 0.69 - modest; $r = 0.70$ to 0.89 - high; $r = 0.90$ to 1.00 - very high. An alpha of 0.05 or less was considered to denote statistical significance.

CHAPTER 3

RESULTS

Subjects

Of the 121 letters and consent forms (Appendix A) sent to the 1996 (n = 60) and 1997 (n = 61) physiotherapy graduates, 80 were returned (Table 3). This represents a 66% response rate. Of the 43 respondents from the 1996 class and the 37 respondents from the 1997 class, there was one respondent from each class who had not taken the PNE, reducing the sample size to 78. Due to the unavailability of current addresses, the author was unable to make contact with 15 graduates: nine graduates from 1996 and six graduates from 1997. There was one graduate from the class of 1997 who was contacted and did not wish to participate in the study (Appendix E- Graduates Contacted and Responses- Flow Chart).

Table 3: Sample Demographics

Year	Graduates	*Graduates Taking PNE	Graduates Contacted	Responses	Respondents Taking PNE
1996	60	54	51	43	42
1997	61	58	55	37	36
Combined	121	117	106	80	78

* Information taken from the UWO PNE report

A total of four respondents were unsuccessful on the PNE. Of the 42 respondents from the 1996 class who took the PNE, three were unsuccessful. Of these, one had a passing score on the MCQ and passed sufficient OSCE stations, but failed the OSCE due to unsafe professional practice; another did not have a passing test score on the OSCE and

did not pass a sufficient number of stations; and the third did have a passing score but failed the OSCE due to an insufficient number of passed OSCE stations.

Of the 36 respondents from the 1997 class that took the PNE, one was unsuccessful on the PNE. This was due to an insufficient OSCE test score and an insufficient number of passed OSCE stations. Although four graduates who failed the PNE responded to this study, the UWO PNE reports indicated that there were 11 graduates in total that were unsuccessful on the PNE. A total of seven failures were from the 1996 class and four were from the 1997 class.

Table 4: Mean (SD) for Age, GPA and Clinical Placement Scores.

		Graduates		
		Combined	1996	1997
Respondents	Male	24	13	11
	Female	54	29	25
	n	78	42	36
	Age * (years)	25 (2.1)	25 (2.1)	24.8 (2.1)
	Mean GPA (%)	81.4 (3.4)	81.8 (2.7)	81.8 (2.7)
	Clinical Mean**	344.7 (13.9)	344.1 (14.0)	345.3 (14.0)
Class	Male	39	17	22
	Female	82	43	39
	n	121	60	61
	Mean GPA (%)	81.1 (3.4)	80.4 (3.9)	81.3 (2.9)

* Age at the time of taking the PNE

** Appendix C- Glossary of Terms

No significant differences were observed between the respondents and the respective class scores for Academic GPA, or between the 1996 and 1997 respondents on age, Academic GPA and the Mean Clinical Placement score, on the t-test (Table 4).

Academic and Clinical Scores

The correlations between Year 1, 2, and 3 GPA, *and* individual Clinical Placement scores varied widely from $r = -0.03$ to 0.32 , ($r \geq 0.22$ significant at 0.05 level) as did the correlations between the Mean GPA *and* individual Clinical Placement scores ($r = 0.05$ to 0.33 ; $r \geq 0.22$ significant at 0.05 level) (Table 5).

Table 5: Correlations between the GPA and Clinical Placement Scores ($n = 78$).

Program Year	Clinical Placements						Mean Clinical Score
	Intermediate (PT 382)			Senior (PT 482)			
	2	3	4	5	6	7	
Year 1 GPA	0.16	0.22*	-0.03	0.18	0.13	0.32**	0.31**
Year 2 GPA	0.09	0.21	0.02	0.10	0.23*	0.28*	0.27*
Year 3 GPA	0.16	0.15	0.18	0.08	0.30**	0.26**	0.34**
Mean GPA	0.15	0.22*	0.05	0.14	0.24*	0.33**	0.35**

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

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

Correlations between the Year 1, 2, 3 and Mean GPA, *and* the Mean Clinical score were low ($r = 0.27$ to 0.35 , $p < 0.05$) but were more consistent than those for the individual

placement scores; and were similar to those for placements 6 and 7, where seven of the eight correlations were between $r = 0.23$ and 0.33 , ($p < 0.05$) (Table 5). These correlations were also similar to the correlation between the MCQ *and* the OSCE components of the PNE ($r = 0.26$, $p < 0.05$) for all respondents.

Academic and PNE Scores

Correlations between Year 1, 2, 3, and Mean GPA, *and* the Total PNE scores varied from $r = 0.32$ to 0.58 , ($p < 0.01$) and were similar to those between GPA *and* MCQ scores ($r = 0.38$ to 0.57 , $p < 0.01$). These correlations were consistently higher than the correlations between GPA *and* OSCE scores ($r = 0.25$ to 0.31 , $p < 0.05$) (Table 6).

Table 6: Correlations between GPA and PNE Scores ($n = 78$).

Program Year	PNE Components		Total PNE Score
	MCQ	OSCE	
Year 1 GPA	0.55**	0.25*	0.52**
Year 2 GPA	0.54**	0.27*	0.52**
Year 3 GPA	0.38**	0.30**	0.32**
Mean GPA	0.57**	0.31**	0.58**

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

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

Correlations between the Year 1, 2 and Mean GPA, *and* the Total PNE and the MCQ scores were consistently higher than those between the Year 3 GPA *and* the MCQ score.

The correlations between the Yearly and Mean GPA, *and* the OSCE score were more consistent ($r = 0.25$ to 0.31 , $p < 0.05$), but tended to increase slightly from Year 1 to Year 3, with the highest correlation ($r = 0.31$, $p < 0.01$) between the OSCE score and the Mean GPA (Table 6).

Clinical Placement and PNE Scores

Correlations between Clinical Placement scores, *and* Total PNE and OSCE ($r = 0.20$ to 0.36 ; $r \geq 0.22$ significant at 0.05 level) scores were consistently higher than those between Clinical Placement scores *and* MCQ scores ($r = 0.06$ to 0.16 , $p > 0.05$). There was a tendency for the Senior (PT 482) Clinical Placement scores to be better correlated with MCQ and the Total PNE score than were the Intermediate (PT 382) Clinical Placement scores. However, correlations between the Clinical Placement *and* OSCE scores were more consistent across level of placement (Table 7).

Table 7: Correlations between Clinical Placement and PNE Scores ($n = 78$).

Clinical Placement Score	PNE Component		Total PNE Score
	MCQ	OSCE	
Intermediate (PT 382)	0.06	0.29*	0.20
Senior (PT 482)	0.16	0.29*	0.27*
Mean Clinical Score	0.16	0.36**	0.32**

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

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

CHAPTER 4

DISCUSSION

The present sample of respondents from the UWO PT class of 1996 and 1997 coincided with the first two years of the administration of the PNE, consisting of both the MCQ and OSCE components. The response rate in the present study of 66% approached the high limit for survey response rates as reported by Portney and Watkins (1993). In addition to completing a one page questionnaire, respondents were requested to send a copy of their PNE results to the researchers. However, 25 of 78 respondents (32%) had lost or discarded their PNE results. Their exclusion would have reduced the subject pool to 53 graduates, resulting in a response rate of only 43%. The missing PNE results were subsequently acquired from the Alliance, with the consent of the graduates. Typically, individual candidate information on the PNE is not made available to the PT programs, necessitating this action.

In one study by Roehig (1988), graduates signed a consent form at the time of the Physical Therapy Examination, which allowed the Professional Examination Service (PES) to release their exam results to researchers. The total number of subjects was 63 of 77 graduates, as only 10 graduates did not sign the consent form and results were unavailable for four other graduates. This represents a more complete data set, or a much higher rate of response, than the present study and suggests that consent at the time of signing up for the licensing examination or prior to graduation would be preferable to post hoc consent, as used in the present study.

Of the UWO PT classes of 1996 and 1997, 117 out of 121 graduates wrote the PNE,

however only 106 graduates were actually able to be contacted in the present study. This was due to the inability to get current addresses for all the graduates. Of the 106 graduates that were contacted, 80 graduates responded. However, two of these respondents did not take the PNE.

Of the graduates that were unsuccessful on the PNE, only three of seven from the class of 1996 and one of four from the class of 1997 responded to the present study. A possible reason for the lack of response from the seven other graduates that were unsuccessful on the PNE may be that they did not want to reveal their identity. Of the 26 graduates contacted that did not respond to this study, it is unknown if these graduates had not taken the PNE or if they did not wish to participate in the study. As a result, the extent to which the respondents and non-respondents are comparable on PNE data is unclear.

In the present study, the data from the respondents of the 1996 and 1997 UWO PT graduates were combined, because the course content and clinical placement requirements of the program remained essentially the same. This was considered acceptable since no statistically significant difference was observed between the 1996 and 1997 respondents on GPA and on the Mean Clinical Placement scores, and between the respondents and respective class scores on GPA. The GPA data of the combined 1996 and 1997 respondents were normally distributed and there was homogeneity of variance (Levene's test).

Academic and Clinical Scores

Although UWO data were available for all 121 students, analysis was confined to only

those who had completed the PNE. In this way, the same sample provided data for both the analysis of UWO and PNE data. In the present study, the correlation between the Overall Mean GPA and the Mean Clinical Placement scores within the program was low ($r = 0.35$, $p < 0.01$). Similar findings were reported by Tidd and Conine (1974), who reported the correlation between the Clinical GPA and the Total College Academic GPA was $r = 0.39$, ($p < 0.01$), and by Olney (1977), who reported the correlation between the Aggregate Clinical Placement score and the Year 3 GPA was $r = 0.37$, ($p < 0.05$). In the present study, the correlation between the Mean Clinical Placement score and the Year 3 GPA was similar ($r = 0.34$, $p < 0.01$) to that reported by Olney (1977).

In general, as the clinical experience of the students increased, the strength of the relationship between Clinical Placement scores and Academic GPA tended to increase. This may be explained by the fact that final year students, in their last three clinical placements, are expected to be approaching entry level skills and competencies. Cox et al (1999) identified a pattern of increasing ECC scores from placement 2 to placement 7, with a greater increase occurring from placement 2 to placement 4 than from placement 5 to placement 7, and a transitional zone between placements 4 and 5. Also, the acquisition of physiotherapy competencies of UWO PT students began to plateau in the final year after a minimum of 18-19 weeks of clinical experience (after 5 clinical placements). Although an additional 10 weeks of clinical work produced higher ECC scores, these scores were not significantly higher (Cox et al 1999).

In the present study, seven of eight correlations between the two final senior clinical placements (placements 6 and placement 7) *and* the Yearly and Mean GPA were between

$r = 0.23$ and 0.33 , ($p < 0.05$) which were more consistent than those for clinical placements 2 through placement 5 (Table 5). Although these correlations were low, they were comparable to the correlation between the academic (MCQ) and clinical (OSCE) components of the PNE ($r = 0.26$, $p < 0.05$). Similar correlations were reported for a pilot test of two different OSCEs administered at four sites (Reznick et al 1992). In that study, the correlation between the Medical Council of Canada Qualifying Examination (MCCQE) consisting of four exams (three MCQ exams which tested knowledge and a new format which tested clinical reasoning) and the OSCE was $r = 0.23$ for form A and $r = 0.26$ for form B (and $r = 0.32$ and 0.35 respectively, when corrected for attenuation).

A higher correlation was reported by Harden et al (1975) between a written MCQ exam and an initial investigation of an OSCE ($r = 0.63$, $p < 0.01$). Low-to-modest correlations were later reported between the MCQ and OSCE, by Reznick et al (1997) of $r = 0.38$ to 0.58 for the 1993 and 1994 administrations of the MCCQE Part-II as the clinical component of the MCCQE. Moderate correlations were considered acceptable for the situation as it was suggested that very high correlations would make the OSCE and the MCQ redundant, especially since the MCCQE Part-II was developed to test aspects of clinical competency that are fundamentally different and not tested in Part-I (Reznick et al 1997).

Modest-to-high correlations were also reported by academic programs in medicine (Famuyiwa et al 1991, Coovadia and Moosa 1985, Matsell 1991, Williams et al 1987). Famuyiwa et al (1991) reported that the correlations between a psychiatry OSCE given to preclinical medical students and the MCQ component of the Traditional Long Case

Assessment were $r = 0.57$, ($p > 0.05$) and $r = 0.68$, ($p < 0.05$). However, more inconsistent findings were reported by Coovadia and Moosa (1985), in that the correlation between the paediatric MCQ and the OSCE was moderate ($r = 0.59$ and 0.56 , $p < 0.01$) in only two of seven groups of students, low ($r = 0.32$ to 0.39 , $p > 0.05$) in three of seven groups and slight ($r = 0.04$ and 0.13 , $p > 0.05$) in two of seven groups. The results of the present study and previous research support the concept that the MCQ and the OSCE test two distinct aspects of competency. Until a single test is developed which has higher correlations with the MCQ and the OSCE, two types of exams appear to be necessary to assess both knowledge based and clinical based information.

Matsell et al (1991) reported a strong correlation ($r = 0.79$, $p < 0.01$) between an OSCE and the Overall Standard Assessment for a paediatric clerkship, as well as its components consisting of a problem solving component ($r = 0.63$, $p < 0.01$), an interim MCQ ($r = 0.64$, $p < 0.01$), a final MCQ ($r = 0.65$, $p < 0.01$), and a Faculty Ward Evaluation ($r = 0.54$, $p < 0.01$). Williams et al (1987) examined medical student performance on an OSCE developed for medical clerks as a final check on clinical competency of medical students and to evaluate their readiness for postgraduate education. The correlation between this OSCE and the Combined Score of Clinical Competency (as assessed by teachers in various disciplines) was $r = 0.65$, ($p < 0.01$). The correlation between the OSCE and the National Board of Medical Examiners (NBME) Part 1 ($r = 0.53$, $p < 0.01$) and Part 2 ($r = 0.51$, $p < 0.01$) was lower, but still moderate. These findings support the suggestion that the OSCE is more related to other tests of clinical skills and clinical reasoning than is the MCQ, which tests predominately

knowledge.

In the present study, the low correlation between the OSCE and the MCQ components of the PNE might be considered problematic. However, it followed the same trend observed for the correlations between the Yearly and Mean GPA *and* the Mean and final two Clinical Placement Scores for the UWO PT program. Although the results of the present study appear consistent with other studies (Tidd and Conine 1974, Olney 1977), the correlation between academic and clinical performance was lower than one might expect, since students with good academic achievement might be expected to perform better in clinical placements. Also, a higher correlation between clinical placement scores and academic achievement for UWO graduates might have been anticipated since most PT courses included a practical component as part of the course grade (typically 40% of the final grade). In addition, calculation of the overall GPA included the scores of those PT courses, as well as courses without a lab component.

The mean of all external and internal (PT) courses combined was used in the present study because attempting to filter out courses on the basis of the strength of their clinical component was considered highly subjective and impractical. Also, all external and internal (PT) courses were considered to have contributed to the achievement of an acceptable knowledge base, and the necessary physiotherapy skills and competencies required for entry level physiotherapy practice. Moderate correlations were reported by Tidd and Conine (1974) between the Clinical GPA and the GPA of PT courses ($r = 0.43$, $p < 0.01$), and by Olney (1977) between the Clinical Placement Aggregate score and the Electrotherapy and Manipulations Course score ($r = 0.46$, $p < 0.05$). These studies

suggest that specific PT courses that include subject matter that is more related to clinical skills may relate better to the Clinical Placement GPA.

Another explanation for a low correlation between the Overall GPA and Clinical Placement scores may be related to the fact that these scores are actually measures of distinct aspects of physiotherapy competency. The Overall Mean GPA may be a measure of predominantly knowledge base, but Clinical Placement scores may test other abilities related to clinical skills performance. Traits evaluated in clinical placements may include manual dexterity or technical skills, documentation, organization and time management, critical thinking, communication and interpersonal skills. While the GPA and Clinical Placement scores test different aspects of physiotherapy competency, both contribute to the acquisition of physiotherapy skills and competencies required for entry level practice. Therefore, both sources of information may be necessary and low correlations may be appropriate for this situation.

Low correlations between academic and clinical performance in the PT program at UWO may be also attributed to the use of the ECC (Loomis 1985a) to evaluate performance in clinical placements. Since the ECC was developed 13 years ago, current use of this clinical evaluation instrument may not reflect contemporary physiotherapy practice. Currently, physiotherapy practices that may not be reflected in the ECC include: 1) the greater use of outcome measures, 2) interpretation of scientific method, 3) supervision of physiotherapy assistants and support personnel, and 4) screening for appropriateness of physiotherapy care due to direct access.

The ECC is a criterion referenced evaluation tool that was intended to reflect the

extent to which a PT student performed competencies considered to be required for entry into the profession, as determined by expert clinicians and focus groups. Lower correlations between academic and clinical performance may also be related to different therapists' interpretations of how to score the ECC. It is unclear if therapists scored students according to the behavioural criteria (which represent an increasing acquisition of entry-level competencies) as suggested by the ECC, which is the recommended practice, or according to what they expected of a student at the intermediate or senior level.

The weighted ECC score developed by members of the Clinical Experience Committee (CEC) at the UWO was used in the present study. For the purpose of arriving at a numerical score for clinical placements, CEC members gave each item a relative weight of two or three, based on the consensus of the group, which reflected the relative importance of each item. Although this weighting system differed slightly from the weighting system developed by Loomis (1985a), changes in item weight decided by the CEC members were based on their interpretations of relative importance of each item. However, using the CEC weighting system may have limited the generalizability of these results to the specific weighting system used for scoring the ECC in the present study. The extent to which other PT programs modify the weighting for the ECC score is unclear. Whether the raw score of the ECC or another weighting system may have produced higher correlations with academic or PNE data are also unclear.

Academic and PNE Scores

The inter-relationship of academic achievement and licensing examination performance was evaluated using the Yearly and Overall GPA of 1996 and 1997 graduates, *and* the

MCQ and OSCE components of the PNE. To date, few studies in physiotherapy have been published which evaluated the relationships among these variables. Since 1996, the Canadian licensing examination (PNE) has consisted of a written (MCQ) and a clinical (OSCE) component. In the present study, the correlations between the Year 1, Year 2 and the Overall Mean GPA *and* the MCQ were modest ($r = 0.54$ to 0.57 , $p < 0.01$). However, the correlation between the Year 3 GPA *and* the MCQ was low ($r = 0.39$, $p < 0.01$).

The stronger correlations between the MCQ *and* Year 1 and Year 2 GPA may be explained by the fact that the external and internal (PT) courses taken in the first two years of the program were more reflective of the fundamental knowledge required to practice physiotherapy at the entry-level. The final year of the program, on the other hand, consisted of only three compulsory courses in PT (biomechanics, administration, advanced topics in psychiatry and pharmacology), a special project course, which could be a literature review or a research study, and two-to-four PT elective courses (sports medicine, geriatrics, occupational health, advanced orthopaedics). The low correlation between the Year 3 GPA and the MCQ might be appropriate since these courses were more specialized and may have been less representative of the fundamental knowledge base of physiotherapy that was tested on the PNE.

Moderate correlations between Year 1, Year 2 and the Mean GPA, *and* the MCQ component of the PNE ($r = 0.55$ to 0.57 , $p < 0.01$) may be considered reasonable, since the GPA and the MCQ likely reflect similar aspects of competency (Table 6). However, the value of the Year 1, Year 2 and Mean GPA scores for predicting the MCQ scores was

questionable. For example, at best, only 33% of the variation in the MCQ score was related to the variation in the Mean GPA score ($r = 0.57$, $p < 0.01$ and $r^2 = 0.33$). The magnitude of the correlation between the OSCE *and* the Yearly and Overall Mean GPA was lower ($r = 0.25$ to 0.31 , $p < 0.05$) resulting in an r^2 of 0.06 to 0.10 . As a result, only 10% of the variation in the OSCE scores could be explained by the variation in the Mean GPA (Table 6). Other potential sources of variation include, lack of experience of PT graduates with the OSCE format, variations in determining individual course GPAs and variations in the make-up of the GPA which may include clinical course content and scores on practical examinations.

This trend toward better correlations between the GPA scores and the MCQ, than between GPA scores and the OSCE may be related to the fact that the GPA reflects primarily knowledge base and to a lesser extent clinical skills. The OSCE, however tests some knowledge, but mostly clinical skills performance and the interpretation of clinical information. Therefore, the GPA and the OSCE reflect different aspects of clinical competence, whereas the GPA and the MCQ reflect more similar areas of competency.

Clinical Placement and PNE Scores

In the present study, the correlations between the PNE and Clinical Placement scores were slight to low ($r = 0.06$ to 0.36 ; $r \geq 0.22$ significant at 0.05 level) (Table 7). The correlation between the Intermediate, Senior and Mean Clinical Placement scores *and* the MCQ were only slight ($r = 0.06$ to 0.16 , $p > 0.05$). However, the correlations between the Clinical Placement Scores *and* the OSCE score were higher ($r = 0.29$ to 0.36 , $p < 0.05$). These correlations were consistent with findings of Davis and Hill (1997b),

who reported that the correlation between the Clinical Placement score and an eight station Objective Structured Practical Examination (OSPE) was $r = 0.39$, ($p < 0.01$). However, their OSPE was developed by the PT program to examine the readiness of PT students for clinical placements and was not used in licensure.

The acquisition of clinical competencies of UWO PT students, as scored by the ECC, began to plateau in the final year, after a minimum of 18-19 weeks of clinical experience (Cox et al 1999). However, ECC scores continued to improve and approached those reflective of entry level with a further 10 weeks of clinical practice in the final two clinical placements (Cox et al 1999). Since the OSCE component of the PNE was designed to examine entry-level clinical competencies, the present author speculated that, as a student approached entry-level, the performance in the Senior Clinical Placements would be more reflective of entry-level physiotherapy practice and would have correlated better with the OSCE. However, the correlation between the OSCE *and* the Intermediate and Senior Clinical Placement scores were the same ($r = 0.29$, $p < 0.01$), despite significantly higher ECC scores on the Senior Clinical Placement (post hoc t-test for Intermediate Clinical Placement score, $\bar{x} = 336.36$, $sd = 18.67$ and Senior Clinical Placement score $\bar{x} = 352.54$, $sd = 15.53$, $p < 0.001$).

Since the ECC was used to score all clinical placements, the low correlations between the Intermediate, Senior and Mean Clinical Placement scores *and* the OSCE may have been due to the possibility that the ECC did not rate students according to the same competencies as did the OSCE. Although the OSCE and clinical placements both examine clinical skills performance, the clinical placements may actually test students on different

aspects of clinical competency than the OSCE.

For example, the OSCE may examine a student's ability to perform a therapeutic technique or an assessment technique and interpret the test results, but it does so in an artificial test situation. During clinical placements, students are also graded on their interpersonal and communication skills, the progression of patient care, as well as organization and time management skills within a "real-world" clinical situation. The use of large-scale OSCEs in PT programs may be useful in providing a more objective measure of clinical skills performance and could be designed to reflect different levels of physiotherapy competencies.

In the case of failure of a clinical placement, the author chose to substitute the remedial clinical placement score, rather than using a failing ECC score. The remedial score was considered the minimum requirement for graduation from the UWO PT program and reflected the student's most recent clinical placement performance. Therefore, these clinical placement scores did not identify the graduates who had failed a clinical placement due to weaker clinical skills, and who may have also struggled with the OSCE.

Of the 78 respondents from the UWO PT class of 1996 and 1997, a total of four were unsuccessful on the PNE. All the failures on the PNE were due to unsatisfactory performance on the OSCE, however only one respondent failed due to an insufficient OSCE test score. Other reasons for failures were an insufficient number of passed OSCE stations and unsafe professional practice. In this study, the first attempt OSCE and MCQ scores were used. Since only one of four graduates who were unsuccessful on the OSCE failed because of an insufficient composite score, the use of the test scores alone may not

have been reflective of success or failure on the OSCE. This may have been another factor contributing to the low correlation between the Intermediate, Senior, and Mean Clinical Score *and* the OSCE and total PNE scores ($r = 0.20$ to 0.36 ; $r \geq 0.22$ significant at 0.05 level).

Further investigation indicated that two of the four respondents who failed the OSCE component of the PNE, also had to repeat at least one clinical placement prior to successful completion of the UWO PT program. However, the usefulness of the Clinical Placement scores in predicting PNE scores would be minimal for the MCQ ($r^2 = 0.004$ to 0.03) and slight for the OSCE ($r^2 = 0.08$ to 0.13). At best, only 13% of the variation in the OSCE score could be explained by the variation in the Mean Clinical Placement score. Other potential sources of variation include, variations in student performance among clinical placements, supervising therapists' scoring differences, and differences in interpretation of the use of the ECC as a measure of clinical competency.

LIMITATIONS

Physiotherapy graduates are highly mobile individuals, and tend to take locum positions where these are geographically available. One of the main difficulties in the present study was tracking down PT graduates one to two years after graduation. Because the sample size was dependent on the response rate for consent and PNE results, a random sample was not used. Of the 121 graduates from 1996 and 1997, 80 responded. Although this represented 66% of the total sample, the extent to which inclusion of all the graduates in the data set would have affected the outcomes is unclear. Two of these respondents did not write the PNE and were subsequently excluded from the data set.

Post hoc comparison with the independent t-test of the 78 respondents and the 121 total sample indicated no significant difference on overall mean GPA ($p > 0.05$). However, it was unclear if the respondents were also representative of the total class on other variables such as Clinical Placement scores and PNE performance.

In this study, a total of three mail outs were required in order to achieve the final sample size. Also, time was spent making follow up phone calls to ensure that graduates had received their letter of information and consent forms. However, there were a total of 15 graduates that the author was unable to contact.

A major reason for contacting graduates was to request a copy of their PNE results. Twenty-five respondents had lost or discarded their PNE results. Consent of the respondents to request the Alliance to provide copies of their PNE results to the researchers was requested. Alternatively, consent may be requested by the Canadian Alliance of Physiotherapy Regulators at the time of signing up for the PNE or by the university programs prior to graduation. This information should be readily available to the university PT programs, so that they could regularly examine the relationship between academic, clinical and PNE scores.

The present study focused on UWO PT graduates of the classes of 1996 and 1997, during which time no major curriculum changes were made. Although studies of other programs may be undertaken to examine these relationships for other programs, these studies should be based on graduates over several years to account for the course and curriculum modifications made by the individual programs over time. Due to the variations between PT programs in teaching and presentation style, clinical placements,

different faculty and area of emphasis, as well as differences in methods of evaluating academic and clinical achievement, the results of this study cannot be generalized to other PT programs.

A major limitation in the present study may be attributed to the variations in the measurements used. In addition to assessing knowledge base, the Academic GPA scores include clinically based content and components of practical examination scores. These scores may also vary based on the different methods of determining the GPA. Although clinical placement scores were all based on the ECC, these scores may vary highly due to supervising therapists' use and interpretation of this evaluation tool, as well as students' variation of clinical performance across clinical placements.

At this time, no universally accepted gold-standard exists to judge the validity of Academic and Clinical Placement scores in PT programs, or the PNE. As a result, definitive conclusions about the adequacy of the variables used in the present study as measures of clinical competency cannot be made. According to Norcini (1998), the Alliance had engaged in an extensive program to ensure that the content of the OSCE was appropriate, and he recommended that further research should investigate the relationship of the OSCE scores to educational achievements and practice competence. However, at this time, the extent to which the academic and clinical performance in the PT program or performance on the PNE is more reflective of a "gold standard", is unclear.

Although the specific questions used in the PNE differed each year, the format was the same in 1996 and 1997. There were slight differences in the passing scores of the 1996 and 1997 OSCEs. The June 1996 OSCE had a minimum passing score of 361 and 14

stations and the November 1996 OSCE had a minimum passing score of 377 and 11 stations. The September 1997 OSCE had a minimum passing score of 282 and 12 stations. Regardless, the mean (500) and standard deviation (100) of each OSCE and the MCQ passing score (180) remained the same each year.

The standardized score was used in the present study because standardized scores were used by the Alliance for decision making and were reported on the notification of PNE results. Whether the use of absolute scores would have resulted in stronger correlations is unclear. Also, an alternative statistical approach might have been to use a Spearman Rho rank-order coefficient, which ranks the scores rather than using their absolute value.

The PNE is relatively new to the Canadian physiotherapy profession and has been implemented in its current format with both the MCQ and OSCE components since 1996. The present study was limited to the first two years of implementation of this examination.

FUTURE RESEARCH

The present study focused on only one university PT program. While the approaches of PT programs across Canada may differ significantly, PT graduates in Ontario, Alberta, British Columbia and Prince Edward Island must successfully complete the PNE before receiving a license to practice physiotherapy in those provinces. Future research may examine the relationships between academic, clinical and licensure performance based on the different approaches to education or different PT programs.

The School of Physical Therapy at UWO is considering major curriculum modifications with a change in approach from a more traditional teaching method, relying on classroom lecture, to an approach which relies on more student self-directed learning and

consideration of cases. Future research should continue to investigate the relationship of academic, clinical and licensure performance of graduates of the proposed new curriculum and compared those outcomes to graduates in the current PT program.

CONCLUSIONS

The interrelationships between the academic, clinical and licensure performance of UWO PT graduates were, at best, modest. Although the relationship between academic and clinical placement scores varied widely, there was a tendency towards higher correlations between the Academic GPAs and the final two Clinical Placement scores in the UWO PT program ($r = 0.23$ to 0.33 , $p < 0.05$). This relationship was similar to the correlation between the MCQ and OSCE components of the PNE ($r = 0.26$, $p < 0.05$).

Academic scores (GPA) correlated better with the MCQ component of the PNE, and Clinical Placement scores correlated better with the OSCE component. These findings suggest that the GPA and MCQ scores assess similar aspects of competency, related predominantly to knowledge base, and that the Clinical Placement and OSCE scores assess aspects of competency related to clinical skills performance. Although consistent with previous studies, the low correlations between knowledge-based measures and clinical performance-based measures suggest that different aspects of clinical competency are being examined. If this relationship is accepted, both academic and clinically oriented examinations appear to have a place as evaluative tools in PT programs and licensing examinations, to ensure that both aspects of clinical competency have been adequately tested. However, it remains unclear whether academic and clinical performance in a PT program, or performance on the PNE should be viewed as the gold standard.

Appendix A: Letter of Information and Consent Form

LETTER OF INFORMATION (Retained by graduates)**Title: Interrelationships Among Academic, Clinical Placement and Licensing Examination Scores of UWO Physical Therapy Graduates**

Investigators: John Kramer PhD, Peter Cox MSc, Lila Abboud BScPT

You are being asked to participate in a study which examines the relationship between scores achieved during academic and clinical courses in the UWO Physical Therapy Program, as well as the relationship between these scores and those achieved on the physical therapy licensing examination - Physiotherapy National Examination (PNE). This information will help the faculty of the physical therapy program evaluate the curriculum.

If you agree to participate in this study, we request that you complete the enclosed questionnaire and the informed consent signature page, and return these to us along with a copy of your PNE (written and OSCE) results. This consent form approves access to your academic files here at UWO, by the investigators. From your file we will record your yearly and overall grade point averages, and your grades on several courses such as PT320 , PT 330, and PT345. Your clinical practicum evaluations in PT382 and PT482 will be converted into a numerical score and these will also be recorded.

You will be assigned a code number when you enter the study, and all information about your academic, clinical placement and PNE scores will appear in conjunction with this code number. Your name will not appear on any data forms or publications resulting from this research.

No persons other than the investigators will have access to your records or the data files for this study.

Your participation is voluntary. You may refuse to participate or withdraw from the study at any time. If you have any questions, please contact Dr. John Kramer at 519-679-2111 ext 8946 or Lila Abboud at either 661-3371 or 661-3360.

INFORMED CONSENT SIGNATURE PAGE (Please Return This To The Investigators)

Title: Interrelationships Among Academic, Clinical Placement and Licensing Examination Scores of UWO Physical Therapy Graduates

Investigators: John Kramer PhD, Peter Cox MSc, Lila Abboud BscPT

I have read the accompanying letter of information and agree to participation in the study.

Date: _____

Signature: _____

Appendix B: Questionnaire

QUESTIONNAIRE (Please Return This To The Investigators)

Title: Interrelationships Among Academic, Clinical Placement and Licensing Examination Scores of UWO Physical Therapy Graduates

Investigators: John Kramer PhD, Peter Cox MSc, Lila Abboud BscPT

Questions

1. If you are practicing physical therapy, please indicate where and in what specialty area:

2. How many years of post-secondary school education (typically university) did you complete prior to enrolment in the physical therapy program at UWO?

_____ years

3. If you took the PNE:

How old were you when you took the PNE? _____ years and months

How many weeks elapsed between graduation and taking the PNE?
_____ weeks

How long did you work on a supervised practice licence? _____ weeks

What area or areas of specialty did you work in while on a supervised practice licence?

Please complete this questionnaire and return it, along with your signed consent form and PNE report to the UWO Physical Therapy Program (using the pre-addressed stamped envelope).

Appendix C: Glossary of Terms

Appendix C: Glossary of Terms

PNE - Physiotherapy National Examination which is reported as a standardized score with a mean of 500 and a standard deviation of 100. It is made up of two parts: the multiple choice examination (MCQ) and the objective structured clinical examination (OSCE).

Total PNE Score - The total of the MCQ and OSCE scores. This value is not in the notification of PNE results reported to the graduates, but was calculated for the present study.

Clinical Placement Score - A weighted total score calculated from the Evaluation of Clinical Competency (ECC) (Loomis 1985) using the scoring system developed by members of the Clinical Experience Committee (CEC) of the School of Physical Therapy, Faculty of Health Sciences, the UWO. The minimum passing score for Intermediate and Senior Placements was 256 and 293, respectively. The maximum weighted score of the clinical evaluation form was 380.

PT 382 Score - The average of clinical placements 2, 3 and 4.

PT 482 Score - The average of clinical placements 5, 6 and 7.

Mean Clinical Placement Score - The average of all clinical placements:

$(2 + 3 + 4 + 5 + 6 + 7 / 6)$.

GPA Score - Grade point average for each year (1, 2 and 3) of the program. This average consisted of all physiotherapy and other courses. The maximum score was 100%.

Mean GPA Score - The average of the year 1, 2, and 3 GPA scores.

Years PSSE - The number of years of post-secondary school education prior to enrolment in the UWO physiotherapy program.

Weeks of Practice - The number of weeks that graduates practiced under a supervised licence prior to challenging the PNE. Supervised practice typically occurs between graduation and the time the graduate takes the PNE (about three months).

Admission average - The GPA used by the School of Physiotherapy to determine an applicant's eligibility for admission into the UWO physiotherapy program.

Coefficient of Determination (r^2) - When multiplied by 100, can be interpreted as the variance in y that is related to the variance in x (Weber and Lamb 1971).

Entry-Level Competencies (Entry to Practice) - the repertoire of measurable, observable, behaviours that are expected of a physiotherapist entering practice upon graduation from an accredited Canadian physiotherapy program (Glover Takahashi 1997, as in the Competency Profile for the Entry-Level Physiotherapist in Canada).

Competency - A cluster of related knowledge, skills and attitudes that affects a major part of one's job (a role or responsibility) that correlates with performance on the job, and that can be measured against accepted standards. (Parry 1996, as in the Competency Profile for the Entry-Level Physiotherapist in Canada).

Response Rate- The percentage of all responses in the present study, based on the total number of graduates of the 1996 and 1997 UWO PT program.

Appendix D: Evaluation of Clinical Competency
Grading Recommendations

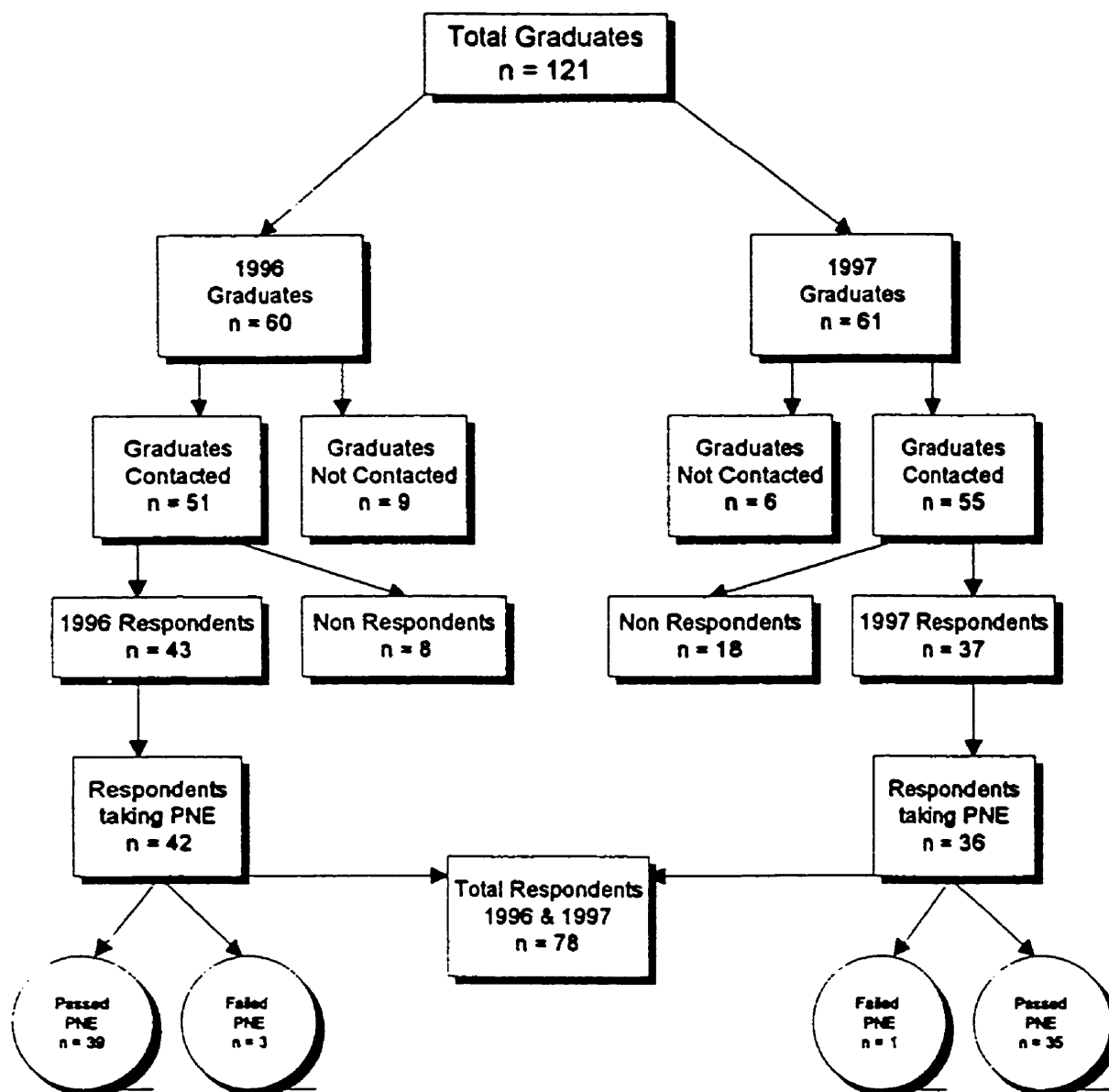
**EVALUATION OF CLINICAL COMPETENCE
GRADING RECOMMENDATIONS (CEC APPROVED)**

Subcompetency & Item	Min. Grade Year III	Min. Grade Year IV	Weighting	Weighted Score (III)	Weighted Score (IV)
A. Patient Evaluation					
1	3	3	3	9	9
2	3	3	2	6	6
3	3	3	3	9	9
4	2	3	3	6	9
5	2	3	3	6	9
6	3	3	2	6	6
				42	48
B. Program Planning					
7	3	3	3	9	9
8	2	3	3	6	9
9	2	3	2	4	6
10	2	3	2	4	6
11	2	3	3	6	9
12	2	3	2	4	6
				33	45
C. Implementation of Treatment					
13	3	3	3	9	9
14	3	3	3	9	9
15	2	3	3	6	9
16	4	4	3	12	12
17	3	3	3	9	9
18	3	3	3	9	9
19	2	3	2	4	6
				58	63

D. Communication with Patient/Family					
20	2	3	2	4	6
21	3	3	3	9	9
22	3	3	3	9	9
23	3	3	2	6	6
24	3	3	3	9	9
				37	39
E. Communication/Management Skills					
25	3	3	3	9	9
26	2	4	2	4	8
27	2	3	2	4	6
28	3	3	1	3	3
				20	26
F. Documentation					
29	2	3	3	6	9
30	2	3	3	6	9
				12	18
G. Professional Behaviour and Growth					
31	4	4	3	12	12
32	3	3	2	6	6
33	3	3	3	9	9
34	3	3	3	9	9
35	3	3	3	9	9
36	3	3	3	9	9
				54	54
TOTALS				256	293

**Appendix E: Graduates Contacted and
Responses (1996 and 1997)**

UWO P.T. Program: Graduates Contacted and Responses (1996 & 1997)



- A total of 26 Graduates were contacted but did not respond to the study
- A total of 15 graduates were "unable to contact"

Appendix F: Notice of Ethics Approval



The UNIVERSITY of WESTERN ONTARIO

*Vice-President (Research)
Ethics Review Board Dental Sciences Building*

REVIEW BOARD FOR HEALTH SCIENCES RESEARCH INVOLVING HUMAN SUBJECTS

1997-98 CERTIFICATION OF APPROVAL OF HUMAN RESEARCH

ALL HEALTH SCIENCES RESEARCH INVOLVING HUMAN SUBJECTS AT THE UNIVERSITY OF WESTERN ONTARIO IS CARRIED OUT IN COMPLIANCE WITH THE MEDICAL RESEARCH COUNCIL OF CANADA "GUIDELINES ON RESEARCH INVOLVING HUMAN SUBJECT."

1997-98 REVIEW BOARD MEMBERSHIP

- 1) Dr. B. Borwein, Assistant Dean-Research - Medicine (Chairman) (Anatomy/Ophthalmology)
 - 2) Ms. S. Hoddinott, Director of Research Services (Epidemiology)
 - 3) Dr. R. Gagnon, St. Joseph's Health Centre Representative (Obstetrics & Gynaecology)
 - 4) Dr. F. Rutledge, London Health Sciences Centre - Victoria Campus Representative (Critical Care - Medicine)
 - 5) Dr. D. Bocking, London Health Sciences Centre - University Campus Representative (Physician - Internal Medicine)
 - 6) Dr. L. Heller, Office of the President Representative (French)
 - 7) Mrs. E. Jones, Office of the President Representative (Community)
 - 8) Ms. S. Fincher-Stoll, Office of the President Representative (Legal)
 - 9) Dr. D. Freeman, Faculty of Medicine & Dentistry Representative (Clinical)
 - 10) Dr. D. Sim, Faculty of Medicine & Dentistry Representative (Basic)(Epidemiology)
 - 11) Dr. M.I. Kavaliers, School of Dentistry Representative (Dentistry-Oral Biology)
 - 12) Dr. H. Laschinger, School of Nursing Representative (Nursing)
 - 13) Faculty of Health Sciences Representative
 - 14) Ms. R. Bullas, London Clinical Research Association Representative
 - 15) Research Institutes Representative
 - 16) Mrs. R. Yohnicki, Administrative Officer
- Alternates are appointed for each member.

THE REVIEW BOARD HAS EXAMINED THE RESEARCH PROJECT ENTITLED:
"Interrelationships among academic, clinical placement and licensing examination scores of UWO physical therapy graduates."

REVIEW NO: E6227

SUBMITTED BY: Dr. J. Kramer, Physical Therapy, Elborn College

AND CONSIDERS IT TO BE ACCEPTABLE ON ETHICAL GROUNDS FOR RESEARCH INVOLVING HUMAN SUBJECTS UNDER CONDITIONS OF THE UNIVERSITY'S POLICY ON RESEARCH INVOLVING HUMAN SUBJECTS.

APPROVAL DATE: 04 December 1997 (UWO Protocol, Letter of Information & Consent)

AGENCY:

TITLE:


Bessie Borwein, Chairman

c.c. Hospital Administration

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