

An Innovative Canadian Solution for Improved Access to Care for Knee Injuries Using “Non-Physician Experts”: The Calgary Acute Knee Injury Clinic

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Abstract

There is a significant burden of musculoskeletal (MSK) disorders on the Canadian healthcare system which emphasizes the need for improved patient flow and integrated services throughout the MSK clinical care pathway. Improving accessibility, effectiveness, acceptability and efficiency of safe and appropriate care of MSK health using innovative models of healthcare delivery has become an important issue for Canada. This paper is a prospective study that describes and evaluates an evidence-based model for management acute knee injuries in Calgary, Alberta, Canada: the Calgary Acute Injury Knee Clinic model (C-AKIC). C-AKIC model development consisted of three stages: 1) development, implementation and evaluation of a new non-physician expert (NPE) curriculum; 2) identification of the logistics for opening the C-AKIC within an urban setting; and 3) evaluation of the accessibility, effectiveness, acceptability and efficiency of the C-AKIC model relative to the current healthcare system. NPE curriculum improved both theoretical knowledge (12% average increase) and clinical competence (33.5% average increase). NPEs evaluated and managed acute knee injuries in an interdisciplinary team (2 NPEs and a primary care physician) at the C-AKIC. Patients were significantly more satisfied with the new clinical care pathway (M = 91.20 out of 100) compared to patients who went through the existing/traditional pathway (M = 75.58 out of 100). Patients also saw fewer healthcare providers in C-AKIC clinical care pathway (M = 2.14) in a shorter period of time (M = 2.09 months) compared to the existing system: M = 2.76 months and; M = 7.24 months, respectively. This project demonstrated a unique and efficient approach to evaluation and management acute knee injuries in an urban setting by providing a potentially viable solution to the need for human resources in the healthcare workforce.

Keywords: Musculoskeletal evaluation and management; Acute knee injury; Clinical care pathway; Interdisciplinary team

Introduction

There is a significant burden of musculoskeletal (MSK) disorders on the Canadian healthcare system which emphasizes the need for improved patient flow and integrated services throughout the MSK continuum of care. Over 15.5 million visits are made to ambulatory physicians in Canada for a MSK problem annually [1]. A study conducted in Ontario showed that 27% of ambulatory physician visits and 9% of emergency department visits were for MSK disorders [2] with comparable figures in the United States [3] and the United Kingdom [4]. MSK disorders, ranked as the second most costly illness in Canada, have an economic burden of \$17 billion per year and accounting for 39% of long-term disability [5]. Early appropriate management and treatment of acute MSK injuries can prevent the development of chronic disease and morbidity [6], such as osteoarthritis, which affects approximately 10% of Canadian adults [7]. However, early appropriate management and treatment requires an efficient clinical care pathway.

Currently, primary care management of MSK disorders involves too many practitioners [8] who lack the necessary training [9] and confidence in MSK examination [2,10-12]. Of the overall Canadian undergraduate medical curriculum for primary care physicians, only 3% is dedicated to MSK education [13]. As a result, the clinical care pathway for MSK health in Canada is inefficient and ineffective. Improving accessibility, effectiveness, acceptability and efficiency of safe and appropriate care of MSK health using innovative models of healthcare delivery has become an important issue for Canada [14]. An alternate approach must be used to create a solution.

Non-physician models that have been proposed engage a team-based approach to evaluation, management and treatment of MSK patients [15-17]. These non-physician models utilize current health human resources such as physiotherapists [18,19] nurse practitioners

[20] or physician assistants [21]. The idea of redefining the roles of an existing health workforce is only a viable solution if the practitioners are not in high demand or have projected shortages. This is not the case for nurses and physiotherapists, who represent two examples of the workforce that are in extremely high demand in Canada [14,22]. The Canadian government does advocate for more generalists to manage care [22]. It is clear that MSK injury requires a specialist level of care to be delivered at the primary care level. Physician assistants have been introduced in Canada to solve some of the health human resource shortage issues [23]. These practitioners are generalists and would have to be retrained to work in the MSK discipline. Nonetheless, these may be some of the potential solutions to manage the problem. However, this begs the question of whether there are other health human resources that are under-employed, under-utilized and would require minimal re-training to work in the MSK discipline? This question underscored the problem and a viable solution is outlined in this paper.

This paper is a prospective study that describes and evaluates an evidence-based model for management acute knee injuries in Calgary, Alberta, Canada: the Calgary Acute Injury Knee Clinic model (C-AKIC). Acute knee injuries were targeted for this pilot because of

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the high incidence of injury in the population [9,24, 25]. This paper defines the development and implementation of each component of the C-AKIC. It also describes the evaluation of the C-AKIC model in terms of its accessibility, effectiveness, acceptability and efficiency compared to the current healthcare system. The C-AKIC involves an innovative web-based screening technology and introduces a new healthcare practitioner, the “Non-Physician Expert” (NPE). The NPE is an individual with an educational background in MSK assessment, such as an athletic therapist. Unlike other non-physician healthcare practitioners, the NPE is trained at a specialist’s competency level, providing a high standard of care within a narrow field (i.e. acute knee injury) in an interdisciplinary team with a supervising physician.

Materials and Methods

The C-AKIC model consists of three stages: 1) development, implementation and evaluation of a new NPE curriculum; 2) identification of the logistics for opening the C-AKIC within an urban setting; and 3) evaluation of the accessibility, effectiveness, acceptability and efficiency of the C-AKIC model relative to the current healthcare system. Methods for each of these aspects of the model are outlined below.

Development, implementation and evaluation the NPE curriculum

The training of athletic therapists as acute knee injury “specialists” was a key component of the C-AKIC. These individuals are academically qualified because they have an undergraduate bachelor degree in athletic therapy and certified by an independent national board (Canadian Athletic Therapists Association). The NPE training process defined a new role (i.e. the NPE) for an existing workforce (i.e. athletic therapist) [26, 27].

The NPE curriculum was designed as a two-month post-graduate training program for athletic therapists but could be applied to other allied healthcare workers such as physiotherapists who also specialize in MSK health. One month of training was dedicated to each phase of the program: 1) knowledge phase and 2) clinical learning phase. The goal was to increase NPE knowledge and clinical skills including patient triage and assessment of patients presenting with acute soft tissue knee injuries; correctly identify differential diagnoses; confirm the diagnosis; and recommend management for knee injuries in an inter-disciplinary team [27].

The curriculum was created following a 6-step curriculum development model [28]. The first step defined the healthcare problem in terms of the current interaction of patients, healthcare professionals, medical educators and society in the clinical care pathway for knee injuries. The second step involved a specific needs assessment of the targeted learners (i.e. athletic therapists). The third step defined the curriculum goals and specific measurable objectives, which were based on the seven competencies, defined by the Canadian Medical Education Directives for Specialists (CanMEDS) Roles [29]. The fourth step established educational strategies that were congruent with the curriculum goals and objectives and were to be delivered in an adult, self-directed learning environment. The fifth step identified the key resources required to successfully implement the NPE curriculum. The sixth step defined methods for evaluation of the curriculum and feedback from the trainees.

Quantitative evaluation of the curriculum and simultaneous validation of the NPEs as competent healthcare providers was achieved using pre- and post-test forms of a Multiple Choice Question (MCQ)

exam and Objective Structured Clinical Examination (OSCEs). Qualitative evaluation included an in-training evaluation report, which was completed by the preceptors of the clinical training component of the curriculum. The qualitative evaluation facilitated discussion between the NPE trainees and preceptors throughout the implementation of the curriculum.

Identifying the logistics of operating the C-AKIC

A needs assessment was completed to identify the logistics of operating the C-AKIC. The first stage determined logical patient flow through the C-AKIC and clinical practice. This included development of patient inclusion criteria. The second stage matched requirements identified during the first stage with physical space requirements. Stage three identified administrative support and equipment requirements. A costing model was proposed for all stages.

Evaluating the accessibility, effectiveness, acceptability and efficiency of the C-AKIC

The Healthcare Access and Patient Satisfaction Questionnaire (HAPSQ) was employed to measure the clinical care pathway to compare patients who went through the C-AKIC. The HAPSQ defined healthcare access using wait times measured in months. Wait time was further broken down as the measure of time from initial injury to definitive treatment. Definitive treatment was defined as optimal or ideal management of an injury once all other options were considered. The number of healthcare professionals a patient encountered was also used as an indicator of healthcare access (i.e. more practitioners seen indicated slower, less efficient access). Patient satisfaction was defined in the HAPSQ with two measures: 1) patient satisfaction with the time spent waiting for a physician consultation; and 2) quality of care received. Responses were assessed on a 100 mm visual analogue scale (VAS) from 0 “extremely dissatisfied” to 100 “extremely satisfied”. Patient satisfaction was broken down into primary care (i.e. including family physicians and emergency room physicians) and specialists (i.e. including Canadian Academy of Sport and Exercise Medicine diploma physicians and orthopedic surgeons).

HAPSQ baseline measures were obtained from 136 patients with knee injuries who were part of the existing clinical care pathway. Baseline patients were consented between May and December 2008 from a convenience sample of patients presenting to the University of Calgary Sport Medicine Centre (U of C SMC), Banff Sport Medicine Clinic and using poster advertisements with all Alberta-based physicians. Baseline patients were compared to 138 patients who came to the C-AKIC and were asked to complete the HAPSQ.

Healthcare access was analyzed by comparing baseline data to data acquired from patients who went to the C-AKIC using an independent t-test for: a) wait time; and b) the total number of practitioners encountered by patients. Patient satisfaction was measured using a one-way analysis of variance comparing satisfaction primary care physicians to specialist care in the baseline measurement (i.e. through the traditional clinical care pathway) and through specialist care in the C-AKIC. For purposes of this study, even though non-physicians were part of the interdisciplinary team that diagnosed and managed patients, they were considered specialists. Furthermore, sport medicine physicians were also considered specialists for purpose of this study even though, by definition through the Alberta Medical Association, they are not considered specialists. Data were analyzed using SPSS ©, version 17.0. This study received ethics approval through the University of Calgary Conjoint Ethics Review Board.

Results

Developing, implementing and evaluating the NPE Curriculum

The NPE curriculum included two phases each requiring one-month to complete. The knowledge phase comprised of 10 two-hour sessions with the faculty member (NM). Specific learning objectives were defined for each session, which included the following topics: anatomy, history and injury mechanisms, associated injuries and referred problems, physical examination, indications for investigations, skeletally immature patients, treatment algorithms and evidence-based medicine. All of the educational strategies defined in the curriculum were effectively used and adapted to the trainees' learning styles. An iterative learner-centred approach required active participation from the learners, the faculty member and the external curriculum developer. Discussion and problem-based learning were the main strategies during the knowledge phase.

Under the supervision of a sport medicine physician or orthopaedic knee surgeon, the clinical learning phase involved experiences with several different preceptors to provide exposure to a variety of different knee-related problems on real patients. A minimum of 17 three-hour clinical sessions were scheduled, whereby the NPE trainees applied information gained from the knowledge phase in the clinical learning phase. Application included history taking, physical examination, interpretation of investigations and application of treatment algorithms.

A comparison of the pre- and post-test MCQ exam scores for the NPE trainees showed an average improvement of 12.0% (8.0-16.0%). The average post-test MCQ exam scores of the trainees was 66.0% (range: 64.0% – 68.0%), compared to an average of 79.3% (range: 72.0% - 90.0%) for the two sport medicine physicians and the orthopaedic surgeon who completed the MCQ exam for construct validation.

The post-test OSCE was administered to the two trainees (NPEs) and compared to three physicians candidates for validation purposes. These candidates included a practicing sport medicine physician, a fellowship trained emergency physician and an orthopaedic resident. Table 1 shows the OSCE scores for the NPE trainees on the two stations included in the pre-test. The minimum performance level (MPL) for these two OSCE stations was 65.0%. Both NPE trainees scored below the MPL on the pre-test, but above the MPL on the post-test. The average improvement of their OSCE scores on each pre-test station was 29.7% and 37.3%. In comparison to the three candidates on the post-test OSCE, the NPE trainees scored above the MPLs on all stations, whereas one candidate scored 2.5% below the MPL on one station. The NPE trainees' average post-test OSCE scores were higher than the candidates on all stations (Table 2).

	Pre-test Score (%)	Post-test Score (%)	Difference (Post – Pre, %)
Station 1		MPL = 65.0%	
NPE 1	35.2	76.4	41.2
NPE 2	59.4	77.5	18.1
Average	47.3	77.0	29.7
Station 2		MPL = 65.0%	
NPE 1	50.0	92.0	42.2
NPE 2	59.3	91.7	32.4
Average	54.7	92.0	37.3

*MPL: minimum performance level

Table 1: Pre- and post-test Objective Structured Clinical Examination (OSCE) scores for the non-physician expert (NPE) trainees.

The in-training evaluation report reflected that the NPEs had excellent interpersonal skills, general knowledge, history taking and physical exam skills. Areas of improvement identified by the preceptors included paying more attention to detail, interpreting and ordering of diagnostic investigations and making differential diagnoses.

Identifying the logistics of operating the C-AKIC

Two physical space requirements were identified by the needs assessment: 1) clinical and 2) administrative. The U of C SMC, including provision of in-kind support for overhead and operating costs during the start-up phase of the C-AKIC, met both requirements.

In order to operate in an efficient, integrated interdisciplinary team-based environment, the C-AKIC model of clinical care required two NPEs and one supervising physician. Clinical space requirements included eight examination rooms, each equipped with x-ray light boxes, examining tables, goniometers, measuring tapes, knee models and computer technology/infrastructure. U of C SMC was also equipped with digital x-ray technology. The effectiveness and capacity of this healthcare delivery model was demonstrated by improved access for knee-injured patients, with twice the volume of patients being seen in the same amount of time. Administrative space requirements were provided for NPEs to review patient data and schedule initial visits for those patients who have acutely injured their knees.

Personnel support was solicited from administrative and information technology (IT) staff. Administrative staff were identified and hired to streamline patient flow throughout the C-AKIC. IT experts developed a web-based screening tool designed to ensure that patients met the scope and intention of the C-AKIC. Patients who wanted to gain access to the C-AKIC could either be referred by another healthcare practitioner (e.g. physician, physiotherapist, and chiropractor) or be self-referred. The goal was to schedule patients in the AKIC within one week. Patients were not included if they had a severe cut or laceration; a wound that may be infected; an obvious bone deformity; a loss of sensation or feeling. Patients were flagged as higher risk if they suffered from any or multiple conditions such as diabetes, heart disease, cancer, kidney disease, neurological disorder and/or a psychiatric disorder.

During the screening process, some basic diagnostic history questions were taken to assist the team when the patient came to the clinic. For example, what was the primary complaint (e.g. pain, instability, dysfunction), when did the injury occur, which leg was injured, the site of pain, previous injury to this knee, sounds or sensations at the time of injury, swelling and the nature of the onset of the injury (i.e. sudden or gradual).

Patient flow included initial consultation with the NPE, who verified patient information provided in the web-based screening process, completed a history, performed a physical examination and made an initial diagnosis or identified whether further investigations (x-ray) needed to be ordered. The initial findings were discussed with the supervising physician. As part of a team-based approach, the NPE and the physician applied a defined consensus standard of care and treatment algorithm for acute knee injuries. A final consensus-based diagnosis and management plan for each patient was conferred.

Evaluating the accessibility, effectiveness, acceptability and efficiency of the C-AKIC

The existing healthcare access as measured by mean wait time and mean number of practitioners seen for a patient's knee injury were 7.24 months and 2.76 practitioners, respectively. The C-AKIC

Station	MPL (%)	NPE 1 (%)	NPE 2 (%)	Average NPE Score (%) (n=2)	Candidate 1 (%)	Candidate 2 (%)	Candidate 3 (%)	Average Candidate Score (%) (n=3)
1	67.9	90.7	71.5	81.1	73.2	75.8	68.6	72.6
2	57.4	71.5	80.0	75.8	78.3	79.1	67.7	75.0
3	66.4	69.8	77.8	73.8	69.4	72.3	69.0	70.3
4	65.0	76.4	77.5	77.0	62.5	85.5	75.7	74.6
5	65.0	92.2	91.7	92.0	84.4	94.3	87.3	88.7

*MPL: minimum performance level

Table 2: Post-test Objective Structured Clinical Examination (OSCE) scores for the non-physician expert (NPE) trainees and candidates.

mean wait time and number of practitioners seen for a patient’s knee injury were 2.09 and 2.14, respectively. The independent samples t-test was performed comparing the existing healthcare access wait times and mean number of practitioners seen to the proposed new model (C-AKIC). There was a significant difference in the mean wait time for the existing clinical care pathway ($M=7.24$ months, $SD = 6.75$) and the mean wait time for the C-AKIC ($M=2.09$ months, $SD = 1.86$): $t(272) = 8.62, p < .05$. There was not a significant difference in the mean number of practitioners seen in the existing clinical care pathway ($M=2.76, SD = 1.10$) and the mean number of practitioners seen going through the C-AKIC: $t(268) = 4.91, p = .75$.

Patient satisfaction with the quality of care provided by primary care physicians (i.e. family physicians and emergency room physicians) was $M = 75.58, (SD = 26.41)$. The mean patient satisfaction with quality of care provided by specialists for patients who went through the traditional clinical care pathway was $M = 89.43, (SD = 14.60)$ and $M = 91.20 (SD = 13.25)$ for care by specialists who went through the C-AKIC. An analysis of variance showed that patient satisfaction, as measured by the quality of care provided was different between the primary care group and the two specialists groupings (i.e. existing clinical care pathway specialist and AKIC specialists), $F(2, 424) = 34.53, p < .001$. Tukey HSD post hoc test for significance indicated the patient satisfaction with the quality of care provided by primary care physicians ($M = 75.58; SD = 26.41$) was significantly lower than the specialists’ quality of care in the existing clinical care pathway ($M = 89.43; SD = 14.60$) and the newly proposed clinical care pathway, C-AKIC ($M = 91.20; SD = 13.25$), $p < .001$. There was no significant difference between the specialists’ quality of care in the existing clinical care pathway relative to the specialists’ quality of care in the C-AKIC.

Patient satisfaction with ‘the time it took to receive the care from primary care physicians’ was compared to patient satisfaction with ‘the length of time it took to see a specialist in the existing clinical care pathway and the specialists’ in the C-AKIC. An analysis of variance showed that patient satisfaction with the length of time it took to see their practitioner was different between the primary care group and the two specialists groupings (i.e. existing clinical care pathway specialist and AKIC specialists), $F(2, 424) = 9.96, p < .001$. Tukey HSD post hoc test for significance indicated the patient satisfaction with wait time to see the primary care physicians ($M = 77.36; SD = 25.57$) and the patient satisfaction the time it took to get into the C-AKIC ($M = 82.74; SD = 21.05$) was significantly higher than the specialists’ quality of care in the existing clinical care pathway ($M = 67.61; SD = 30.75$), $p < .001$. There was no significant difference between patient satisfaction with wait time to get into the primary care physician relative to the specialists’ care in the C-AKIC.

Discussion

The Canadian government advocates for general medical practitioners to manage a broad base of disease and injury [22]. The problem with this strategy as it relates to MSK injury evaluation and management is that physicians are not confident or educated to

evaluate or manage these injuries [2,10-12]. The significant burden of MSK disorders on the Canadian healthcare system emphasizes the need for improved patient flow and integrated services throughout the MSK continuum of care. The current study showed that it is possible to create a new, more effective, efficient and accessible clinical care pathway for evaluation and management of acute knee injuries with the assistance of technology and interdisciplinary team of physicians and non-physicians.

In 1989, the Conference of Deputy Ministers of Health commissioned the Barer-Stoddart Report, which included recommendations to Canadian physician resource policy [15,30]. Among these recommendations was a reduction in the reliance on foreign medical school graduates, a 10% reduction in medical school enrollment and the establishment of new training programs for non-physician personnel to provide direct support to the physicians [31]. This study demonstrated that trained NPEs have the knowledge and competency to deliver the “specialist” level of MSK care in a team-based approach with a supervising physician at the primary care level. The C-AKIC model also demonstrated the possibility of redefining the role of athletic therapists as a skilled non-physician workforce that can appropriately improve the effectiveness, acceptability and efficiency of healthcare delivery for MSK care in Canada.

Healthcare access and patient satisfaction are key metrics underlying an effective, acceptable and efficient clinical care pathway. Standards of care were employed to measure effectiveness of the NPE relative to existing practitioners (i.e. sport medicine physicians and orthopedic specialists). Bollen & Scott [32] reported 22 months from injury to diagnosis for knee injuries in their existing clinical care pathway for knees. The current study reported 7.24 months in the existing clinical care pathway, but also demonstrated success with a clinical care model that was more efficient and arguably, more effective. Current MSK injury evaluation and management is lengthier and results in lower standard of care and poor patient satisfaction.

Patient satisfaction was measured in this study with respect to the quality of care they received and the length of time they needed to wait to accomplish resolution for their knee injury. Patients were not satisfied with the quality of care they received from the existing clinical care pathway going through their primary care physicians. Patients were happy with the specialists’ care they received in both the existing clinical care pathway and C-AKIC. Further, patients were satisfied with the length of time to access a primary care physician, but were not satisfied with the length of time to access specialist care in the existing clinical care pathway. In contrast, patients were very satisfied with both the quality of care they received and the length of time to access ‘specialist care’ in the C-AKIC. This new model of healthcare delivery was acceptable to patients (i.e. higher patient satisfaction) and improved accessibility for patients. Improved accessibility was demonstrated by reduced wait times from injury to definitive treatment (i.e. from 7.24 to 2.09 months) and a decrease in the number of healthcare providers encountered (i.e. from 2.76 healthcare providers to 2.14).

This project demonstrated a unique and efficient approach to evaluating and managing acute knee injuries in an urban setting by providing a potentially viable solution to the need for human resources in the healthcare workforce. The NPE model increases capacity without compromising the traditional roles of physiotherapists and nurses. It also addresses the strategy of using new non-physician models of patient care to address staffing shortages, while using the full extent of education, skill and experience of an athletic therapist to work in a team-based care approach with other practitioners [16,17]. Furthermore, the effectiveness and capacity of this healthcare delivery model was demonstrated by improved access for knee-injured patients, with twice the volume of patients being seen in the same amount of time. The use of technology to gain direct access to specialist level of care and the use of a fully integrated interdisciplinary team is a viable alternative to the existing clinical care pathway for MSK injury evaluation and management.

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