Investigating interpretation of ACC claims in an osteopathy teaching clinic

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Abstract

In New Zealand, osteopaths can lodge Accident Compensation Corporation (ACC) claims, on behalf of patients, for accidental injury. ACC provides treatment and rehabilitation services for patients following injury. Postgraduate osteopathy students practice and develop their skills under supervision at teaching clinics. Anecdotal evidence suggested that a number of potentially eligible ACC claims were not being lodged. This study involved a clinical audit exploring this issue, and possible reasons for misinterpretation of ACC injury claims. *Aim:* To investigate the extent to which new patient files in the osteopathy teaching clinic satisfy ACC's criteria for an injury claim. *Methods:* A clinical audit was performed on 290 new patient records randomly sampled from clinical records between 1st January 2016 to 31st December 2016 and 1st January 2017 to 31st December 2017. Each record was systematically processed and categorised into contingency tables to address each of the objectives. *Findings:* 29.7% of possible claims were not made when they appeared to meet ACC criteria for an injury claim. The overall accuracy was 70.3% (95%CI 64.7-75.5%). Between years 2016 and 2017, the results supported instances of underclaiming for ACC injury. When following the same cohort of students from Year 1 to Year 2 there was no difference in the level of observed accuracy (95%CI for Accuracy in Year 1 = 57.4-81.5% and 64.5-86.9% in the same cohort in their second year). No significant difference in accuracy was identified over time (R^2 = 0.03). *Conclusion:* A significant proportion (~30%) of the sample meet ACC criteria for an injury claim when no claim was submitted. There were no instances of submitting a claim when the clinical history appeared not to meet ACC criteria.

Literature Review

The aim of the following literature review is to introduce the topic of 'clinical error' in teaching clinics and to highlight some of the key points that will be discussed further in the subsequent thesis. The review will highlight the following points: what ACC is, and who can make injury claims; primary healthcare providers, such as osteopaths; and the burden musculoskeletal conditions present, injury and pain.

Skill acquisition

Skill acquisition is the process of learning a skill over time, and 'clinical reasoning' is a skill developed in a student clinic (Taie, 2014). Skill acquisition, clinical reasoning and clinical errors will be discussed, forming the foundation for the purpose of investigating clinical errors. These points introduce themes that will be explored in the subsequent sections of the thesis and contribute toward some insight into areas of discussion.

Role of Accident Compensation Corporation and its relationship with providers

ACC is a New Zealand government Crown entity providing an insurance scheme that offers financial compensation for rehabilitation costs for accidental injuries (Accident Compensation Corporation, 2019a). Eligible healthcare providers, such as medical practitioners and allied health providers (physiotherapists, chiropractors, and osteopaths), can lodge claims with ACC to cover the costs of treatment on the patients' behalf. Injuries need to meet ACC's criteria for lodging as a claim (Accident Compensation Corporation, 2019a). The ACC Treatment Provider Handbook (The Handbook) is for health providers in partnership with ACC who provide treatment and rehabilitation for people in New Zealand. The Handbook was created "to give an overview of what ACC is, how it works and the processes that need to be followed" (Accident Compensation Corporation, 2017, p. 4), and also provides important details about lodging claims. The claiming process is discussed in more detail further in the review. However, the importance highlighted is that primary healthcare providers are required to process claims correctly, as stated in The Handbook, to ensure quality of service for the patient and access to their entitlements under the aforementioned insurance scheme.

Osteopathy in New Zealand

Musculoskeletal practitioners who operate as primary healthcare providers are responsible for the rehabilitation of people with musculoskeletal problems including physiotherapists,

chiropractors, podiatrists and osteopaths (Furlong, 2018). Osteopaths are primary healthcare practitioners who use manual therapy techniques to treat abnormal physical conditions involving the musculoskeletal system, nervous system, circulatory system, connective tissue and internal organs (Osteopathic Council New Zealand, 2019). In New Zealand, osteopaths are regulated under the Health Practitioners Competence Assurance Act 2004 (Ministry of Health, 2018). Currently, osteopathy qualifications that lead to registration are offered at Unitec Institute of Technology (Unitec) in Auckland and Ara Institute of Canterbury. At Unitec, students first complete a three-year Bachelor of Applied Science degree, majoring in Human Biology, covering basic scientific principles including anatomy, physiology, pathology, and osteopathic principles and treatment approaches. Upon entry into the two year Master of Osteopathy, students then undertake a clinical practicum at a Osteopathy Teaching Clinic on campus (Unitec Institute of Technology, 2018). Students practicing in the Osteopathy Teaching Clinic are supervised by registered osteopaths. The supervisor's role is to facilitate the development of students' clinical reasoning skills and other clinical skills. Students are provided with opportunities to treat patients from the general public, and subsequently develop their skills under supervision, to meet the assessment criteria for award of the degree and gaining registration with the Osteopathic Council of New Zealand.

Ensuring good quality of care and high ethical standards contributes to reducing negative health outcomes. A health provider should be making an ACC claim if it satisfies the criteria for cover when a patient experiences an injury. An accepted ACC claim provides the patient with access to funding, which supports them to access the appropriate health care service, and financially supports the patient through the rehabilitation process with the necessary treatment. Patients are entitled to a partial reimbursement of medical costs, transport means, pharmaceuticals, surgical procedures, rehabilitation services, and other types of compensation or reimbursements (Accident Compensation Corporation, 2019a). Unfortunately, many services, such as imaging or private treatment, have a financial cost that can be viewed as a burden for many patients. ACC's funding scheme plays an integral role in successful rehabilitation outcomes (Accident Compensation Corporation, 2019a). The burden of financial stress can be alleviated and the likelihood that the patient will commit to ongoing interventions and ultimately recover from injury is the priority of the health provider. Therefore, it is important that ACC providers accurately submit claims. By doing so, they will reduce potential undue financial strain and promote the patient to continue with their ongoing treatment plans that qualify for funding. Accurate claiming can provide more

effective rehabilitation, improve patient engagement in treatment, and reduce the potential for ongoing impacts from the initial injury. Thus, appropriate claiming needs to be made to improve patient outcomes.

Musculoskeletal conditions, injury and pain

Musculoskeletal conditions are a leading cause for long-term pain and disability, and affect millions of people around the world of all ages (Woolf, Erwin, & March, 2012). Musculoskeletal conditions are described by Briggs et al. (2018) as pain and a reduction in physical functioning. The prevalence of musculoskeletal conditions increases with age, but can also increase with other factors such as lack of physical activity, obesity, and occupation (Woolf et al., 2012). There are many different types of musculoskeletal conditions which result from accidents, long term chronic musculoskeletal disorders such as osteoarthritis or rheumatoid arthritis, as well as chronic musculoskeletal pain such as non-specific low back pain (Woolf & Pfleger, 2003). Musculoskeletal practitioners commonly claim for physical injuries on behalf of their patients. Physical injury is described by ACC as, injury that causes damage to your body (Accident Compensation Corporation, 2019a). Musculoskeletal injury will be expanded on in further sections as a prevalent condition commonly associated with ACC claims (Accident Compensation Corporation, 2019c).

Musculoskeletal injuries fall into two broad categories, traumatic and non-traumatic injuries. Traumatic musculoskeletal injury is caused by an acute traumatic accident and can be described as damage sustained to tissues in response to physical trauma (Whiting & Zernicke, 2008). Non-traumatic musculoskeletal injury is described as arising from repetitive trauma to tendons, bursae, cartilage, muscle or bone that overcomes the body's ability to repair, causing overuse of the musculoskeletal system and often leads to a musculoskeletal condition (Pecina & Bojanic, 2003). Musculoskeletal injuries are commonly caused by accidents and so, are usually traumatic.Most commonly in those exposed to work-related or individual-related risk factors (Costa & Vieira, 2010; Punnett & Wegman, 2004). Work-related risk factors include excessive repetition, heavy physical work, sustained awkward postures (Costa & Vieira, 2010). Individual-related risk factors are high body mass index, smoking, sport, housework (Costa & Vieira, 2010; Punnett & Wegman, 2004). The effect of musculoskeletal injuries on individuals can cause significant personal burdens, which are explored in the next section.

Burden of musculoskeletal conditions

The burden of musculoskeletal conditions are important to discuss as these conditions can lead to a risk of developing into other chronic health conditions and increased mortality (Briggs et al., 2018). Globally, the burden of injury on both the patient and the economy is increasing, aligning with ACC statistics in New Zealand (Accident Compensation Corporation, 2019d; Storheim & Zwart, 2014). In New Zealand, musculoskeletal disorders affect one in four adults, and cost the country more than 570 million dollars a year (Bossley & Miles, 2009). These costs are the result of diagnostic medical imaging, General Practitioner visits, laboratory tests, treatment costs by musculoskeletal practitioners, costs of surgery, medication and pain management, work-related compensations, and other disability costs (Bossley & Miles, 2009). Musculoskeletal health is critical for not only for the ability to function, but also to work and perform normal activities of daily life (Briggs et al., 2018). Musculoskeletal conditions are highly prevalent in everyday life and can have significant and wide-reaching consequences, and therefore, highlights the importance of ensuring appropriate ACC claiming. In turn, appropriate claiming may reduce adverse individual consequences and increase the speed of recovery, supporting patients to continue to work and participate in all aspects of life and society.

Acute musculoskeletal conditions include minor self-limiting musculoskeletal injury such as sprains, fractures and dislocation of joints (FitzSimmons & Wardrope, 2005). The lower back is one of the most common regions affected by musculoskeletal conditions and pain (Bossley & Miles, 2009; Storheim & Zwart, 2014). Mody and Brooks (2012) report that lower back and neck musculoskeletal pain are the leading reason for primary healthcare visits and the most common cause for disability related time off work. Both of these injuries require a substantial amount of care and recovery time for an individual, including the financial cost involved to access adequate and effective treatments. Morbidity from musculoskeletal disorders, including musculoskeletal pain and arthritis, is also an area of increasing concern resulting from the high number of New Zealanders presenting with obesity (Ministry of Health, 2016). Although common musculoskeletal conditions increase with age, many conditions such as low back pain and neck pain are not just conditions of older age (Briggs et al., 2018). However, as the number of people over the age of 65 continues to grow, the burden on society to treat and support the aging population is increasing. Thus, the number of people with musculoskeletal conditions and the cost for New Zealand continues to rise at an increasing rate (Bossley & Miles, 2009).

Not only is musculoskeletal pain a major burden for individuals, but also financially burdening for health systems and social care systems (Woolf & Pfleger, 2003). The burden musculoskeletal conditions have on society is not limited to direct financial costs or impact on society. The burden extends to personal wellbeing, such as psychological stress, disruptions to family and workplace social dynamics, and can negatively impact individuals' quality of life. Therefore, compensation schemes are in place to help overcome the financial costs of accidents and injuries and aids in reducing the impact to individual wellbeing as a result of musculoskeletal conditions. In New Zealand, the Crown entity ACC operates an insurance scheme that aims to cover some of this financial cost. An overview of ACC and lodging a claim process will follow.

Accident Compensation Corporation claiming process

This section aims to provide an overview of ACC and the process involved in making and identifying claims. An accident is defined as being caused by an event or series of events resulting in an injury that arises from application of force, falls, sudden movements of the body and twisting movements of the body (Accident Compensation Corporation, 2019a). When accidents occur, ACC will cover the costs of rehabilitation in line with their legislative obligations (Accident Compensation Corporation, 2019a). The operation of ACC is informed by major health sector legislation including the Health Practitioner Competency Assurance Act, which works to provide practitioner accountability and to protect and advocate for the public's health and safety rights (Accident Compensation Corporation, 2019a; New Zealand Legislation, 2003), but is guided principally by the Accident Compensation Act 2001 (New Zealand Legislation, 2001).

Eligible ACC providers such as general practitioners, physiotherapists, osteopaths and other ACC registered healthcare providers can lodge accident claims on behalf of their patients. There are many types of musculoskeletal injuries and disorders that primary healthcare providers commonly apply to have covered. These injuries are thoroughly explained in The Handbook (Accident Compensation Corporation, 2019a). As described above, The Handbook gives health professionals information and details about ACC and how process and lodge claims. A healthcare provider uses the information they have collected through history taking and examination, as well as their diagnosis, to determine whether a patient appears eligible to make a claim.

The Handbook has a list of 'read codes' for injuries that can be claimed for by a provider. The read code is a series of letters and numbers, selected by an ACC provider, that maps to a diagnosis or type of injury such as, sprains or strains, fractures and dislocations. As stated by ACC, read codes are aligned with an injury to ensure ACC is covering correctly, and aid in determining the type of support, treatment and rehabilitation a patient may require (Accident Compensation Corporation, 2019b). It is important to acknowledge that during clinical practice, clinical errors can occur when selecting and identifying criteria for specific read codes, which will be further discussed in the next section.

Clinical errors

Healthcare professionals are constantly developing ways to reduce clinical errors and ensure the best possible outcomes for patients (Oyebode, 2013). Clinical errors are defined as failing the completion of a planned action as intended, or using the wrong plan to achieve an aim (Oyebode, 2013). An error is determined by first establishing a baseline, which is generally outlined by a governing body in a scope of practice and from clinical guidelines (Richman, Mason, Mason-Whitehead, McIntosh, & Mercer, 2009). Clinical guidelines are defined as "statements that include recommendations intended to optimize patient care" (The American Academy of Family Physicians, 2019, p.1). Clinical guidelines are developed systematically and assist healthcare providers, such as musculoskeletal practitioners in clinical decision-making (Oyebode, 2013). Clinical errors can be due to practitioner incompetence or inadequate knowledge, however most errors in clinical reasoning are due to decision-making under conditions of complexity, uncertainty, stress and pressure of time (Scott, 2009). Scott (2009) suggests the use of professional development programs that expand clinical expertise, seeking second opinions from other primary health care providers, utilising support systems such as peer groups, and implementing quality improvement tools in the form of clinical audits. Self-reflection and feedback through quality improvement clinical audits have also been proposed as an important way to critique a musculoskeletal practitioners own clinical reasoning in different situations (Scott, 2009). The role of musculoskeletal practitioners is to ensure quality of service and safe practice for a patient.

It can be difficult to determine exactly the extent to which clinical errors occur in clinical practice (Richman et al., 2009). Clinical errors can vary significantly in terms of their consequences, and what determines an 'error'. There are four types of clinical errors, which are *diagnostic*, *treatment*, *preventive* and *other* (Balogh, Miller, & Ball, 2015). Diagnostic

error will be of most interest as it is important in relation to lodging an ACC claim. Schiff et al. (2009, p. 1882) defined a diagnostic error as "any mistake or failure in the diagnostic process leading to a misdiagnosis, a missed diagnosis, or a delayed diagnosis." Phua and Tan (2013) suggest that a diagnostic error can result from three different outcomes of making a diagnosis. The first is when a diagnosis is delayed when enough information was available. The second is when the diagnosis is wrong when another diagnosis was made before the correct one. The third, when a diagnosis is missed because a diagnosis was never made. Croskerry (2003) describes diagnostic errors as being commonly caused by cognitive factors, which are also referred to as "cognitive disposition to respond". Cognitive dispositions to respond are a type of cognitive bias (Croskerry, 2003). Cognitive bias results from poor decision making and heuristics (Phua & Tan, 2013). Heuristics is described as the use of 'mental shortcuts' by Phua & Tan (2013) and when used in clinical reasoning, it is intuitive and more prone to biases. More experienced practitioners have a deeper knowledge and can more confidently rely on intuitive professional judgements, whereas beginner practitioners need to be more considered in their approach to decision making (Scott, 2009; Taie, 2014).

An understanding of clinical errors and possible cognitive biases will allow for the development of cognitive debiasing strategies (Croskerry, 2003).The literature highlights several strategies that may improve decision making to prevent or reduce the chance of diagnostic errors (Croskerry, 2003; Phua & Tan, 2013). By implementing these strategies, practitioners can increase their awareness of situations in order to make better decisions and to develop their own clinical reasoning (e.g., Croskerry, 2003; Scott, 2009). Novice practitioners are vulnerable to cognitive bias as they are yet to develop good clinical reasoning skills and enhance their professional judgement accuracy (Scott, 2009). The strategies described by Croskerry (2003) help to support clinicians in understanding these relevant cognitive factors. For example, stress is an important factor that can predispose professionals to fall into poor decision making (Scott, 2009). Other factors that determine the formal actions made by clinicians are past experiences, patient factors, affective state, team factors, ambient conditions, fatigue and sleep (Artino, 2008). The section below will expand on how stress can predispose practitioners to make poor decisions and why this may lead to clinical errors.

Stress, fatigue and clinical errors

Errors in clinical reasoning can be caused by decision-making under acute conditions of stress (Scott, 2009). Stress is described by LeBlanc (2009) as 'General Adaptation Syndrome', which is separated into three phases, and each has an impact on decision-making. The phases are alarm phase, resistance phase, and exhaustion phase (LeBlanc, 2009). Alarm phase is the response of the body when identifying a threat or stressor. Resistance phase is the response of the body when attempting to adapt with the stressor. Exhaustion phase is when the resources and ability for the body are depleted caused by the sustained stress and the body is unable to maintain normal function (LeBlanc, 2009). In the alarm phase under acute stress there is a negative physiological response that occurs. The sympathetic nervous system is activated which affects the heart, breathing, hormones and brain. These affects include increased heart and breathing rate; activation of hypothalamic-pituitary-adrenal axis, which releases the hormone cortisol in the blood; increased cortisol influences the brain and areas associated with cognitive function (LeBlanc, 2009). This review has stated that acute stressors negatively impact performance, attention, memory and decision-making in clinical practice causing clinical errors. This is supported in literature by LeBlanc, McArthur, King, MacDonald and Lepine (2005) supporting that mistakes are made in stressful clinical environments. However, contradicting evidence suggested that in a stressful clinical environment, fundamental technical skill may also be improved (LeBlanc, Woodrow, Sidhu, & Dubrowski, 2008). The findings indicate that stress can be a contributing factor of clinical errors, although individual differences can be reason for variability in how practitioners respond to stress. In the Osteopathy Teaching Clinic students can be under a large amount of stress with a full academic schedule and the pressure of applying newly learned skills in a practicum environment. Coping skills relating to stress reduction have been suggested to work against the negative impacts of stress (Subramaniam et al., 2014). Thus, depending on the practitioner's individual response to stress and application of coping skills, their clinical reasoning and risk of clinical error may be impacted.

Students are in the clinic treating patients whilst having to undertake exams, assignments, and attend lectures. The acute but sustained mental effort of a full academic schedule, prolonged effort, mental and physical exertion is described by DeLuca (2005) as influencing cognitive fatigue. Cognitive fatigue is defined as, "failure to sustain attention that requires self-motivation to optimize performance" (Holtzer, Shuman, Mahoney, Lipton, & Verghese, 2011, p.1). A measure to determine whether cognitive fatigue is experienced by novice

practitioners is a decrease in performance (Holtzer et al., 2011). Fatigue has cognitive and physical components that contributes to medical errors in a clinical setting (Holtzer et al., 2011; Jha, Duncan, & Bates, 2001). Long working hours and poor sleep hygiene has been stated by Jha, Duncan and Bates (2001) to contribute to cognitive fatigue. Therefore, depending on the student's workload, they could be fatigued from lack of sleep or during a challenging period of increased mental exertion. Education about good sleep hygiene may help reduce fatigue and stress coping strategies could improve clinical performance (Jha et al., 2001; LeBlanc, 2009). These findings highlight the need to recognise the potential cognitive fatigue may present when evaluating reasons as to why clinical errors have occurred.

Skill acquisition

Clinical reasoning is a skill that is improved over time. Different attributes are associated with a skill that involves a learned process, problem solving, purpose, replication and a considerable amount of time to reach high levels of expertise (Taie, 2014). Skill Acquisition Theory is described by Taie (2014) as a way to explain the process of learning a skill. Information is developed starting from a set of instructions where conscious decisions are made by a practitioner to determine their subsequent actions in a clinical setting. Then, as a novice practitioner develops into an experienced practitioner, situational responses become intuitive and autonomic highly skilled behaviours (Taie, 2014; VanPatten & Williams, 2015; Dreyfus, 2004). When learning a new skill, such as clinical reasoning, there are conscious actions associated with developing one's reasoning process (Fleming, 1991). However, through prolonged situational practice and use of the knowledge attained over time, the actions associated with certain situations become autonomic and the processes become more intuitive (Taie, 2014). Awareness of the clinical reasoning process through critical thinking and self-regulatory judgement can help a novice practitioner develop as a clinician and avoid clinical errors (Benner, Hughes, & Sutphen, 2008). For example, a novice practitioner can develop their clinical reasoning by critical analysis of previous experiences and self-reflection, and paying conscious attention to how they arrived at a decision, recognising how to respond accordingly to a similar situation. Therefore, as Benner et al. (2008) suggests, expanding pattern recognition knowledge base and clinical experience leads to quicker decisions and fewer errors.

Model of skill acquisition

In a teaching clinic, novice student practitioners have yet to develop the skill acquisition to practice with an autonomic process like that of an expert practitioner. The transition of practitioner's clinical reasoning from an attentive action to an autonomic process can be described using a model of skill acquisition (Dreyfus, 2004). Dreyfus (2004) describes five stages of development, Stage 1 novice, Stage 2 advanced beginner, Stage 3 competence, Stage 4 proficiency, and Stage 5 expertise. Each of these will be introduced below with examples of the development of a practitioner using clinical reasoning in clinical practice.

Novice

A novice practitioner understands how to come to a diagnosis and deconstructs the patient case into organised knowledge structures (Coderre, Mandin, Harasym, & Fick, 2003). Novice practitioners need instructional guidance to prevent being overloaded by a heavy cognitive load (Artino, 2008). An example of instructional guidance in the student clinic is the option of using a template form during the appointment to take notes on during the history and examination of the patient. Novices do not have the same experience and extensive knowledge base to come to the same conclusions as an expert. However, novices are able to use hypothetico-deductive reasoning to determine actions based on their findings (Dreyfus, 2004).

Advanced beginner

An advanced beginner can develop their clinical reasoning further by adding additional meaningful aspects to the instructional guidance (Dreyfus, 2004). For example, in clinical practice an advanced beginner can get a more thorough overview of the patient history before coming to a diagnostic conclusion. The novice gains experience to become an advanced beginner after seeing sufficient examples and recognising patterns with clinical practice and reasoning (Dreyfus, 2004). With more experience, an advanced beginner can identify more relevant aspects of a clinical examination to develop into the competence stage. In this stage, understanding how to come to a diagnostic conclusion becomes easier but wrong choices can cause mistakes. Learning from poor decisions reinforces what is important and subsequently more experience is gained (Dreyfus, 2004).

Competence

The competent performer is not yet experienced enough to react automatically and must consciously make decisions. As they become more proficient they are able to see what is important in a clinical examination but still need to decide what to do when making a diagnostic conclusion (Dreyfus, 2004).

Proficiency

In the proficiency stage they fall back on the hypothetico-deductive reasoning after seeing what needs to be done and then proceed to decide on how to do it. This takes time and therefore they are not yet able to respond intuitively (Dreyfus, 2004).

Expert

After a considerable amount of time the expert has gained enough skill to see what needs to be achieved and able to act immediately to achieve their goal. An immediate, intuitive, situational response is characteristic of expertise (Dreyfus, 2004). This response is characteristic of an expert practitioner and referred to as pattern recognition (Groen & Patel, 1985).

Translating the model of skill acquisition into clinical practice

In clinical practice, clinical reasoning has been described as using two processes, analytic and non-analytic methods (Carraccio, Benson, Nixon, & Derstine, 2008). The analytic method is when a practitioner uses a hypothetico-deductive approach. The hypothetico-deductive approach is a scientific method to formulate a proposed hypothesis and then using the evidence obtained to seek disproval or confirmation of the provisional hypothesis (Godfrey-Smith, 2003). The nonanalytic method is pattern-based recognition and the ability to recognise past clinical experiences with the current situation (Carraccio et al., 2008).

Experienced and inexperienced practitioners use hypothetico-deductive reasoning as a means to seek a diagnostic conclusion (Roots, 2014). However, novice practitioners use this method of clinical reasoning more than an expert practitioner because of lack of experience (Doody & McAteer, 2002; Norman, Young, & Brooks, 2007). Although expert practitioners have an extensive knowledge base and experience to rely on their pattern-based recognition, unfamiliar problems may require the hypothetico-deductive approach for the diagnostic conclusion (Norman et al., 2007; Roots, 2014). Pattern-recognition is more refined in expert practitioners than novice practitioners as they are more familiar with patterns and the relevant

importance of gathered information, as explained using the stages of skill acquisition (Roots, 2014). An example of a novice practitioner would be when they are taking the history and physical examination of the patient. Using a set of rules or templates, a novice practitioner would disregard the presenting complaint and get a large amount of information. Each sign and symptom would be equally as relevant and important. However, they may then have difficulty determining what information is important because of an inability to separate the relevant and irrelevant information when it comes to summarising the history of the patients presenting complaint (Carraccio et al., 2008).

A strategy of teaching to help a novice to acquire the learning they need in order to develop into an advanced beginner, could be to encourage organising their clinical knowledge. Such a strategy might be case based, and teachers help the novice practitioners by pointing out the relevant diagnostic information, eliminate the irrelevant information, highlight features that are important to the diagnosis, and encourage compare and contrasting differential hypotheses to learn the similarities and differences between them (Carraccio et al., 2008). Although an advanced beginner can use the beginnings of a pattern-based method as they experience more patients, they are still heavily dependent on the hypothetico-deductive approach. However, as they gain more experience they can start to develop a process in which they can start to effectively filter the relevant information (Carraccio et al., 2008).

An implication of teaching and learning for an advanced beginner is to gain more experience to identify what diagnoses are common and those that are uncommon. An advanced beginner is encouraged to formulate their own differential diagnoses and treatment plans to further understand clinical cases (Carraccio et al., 2008). A competent practitioner's clinical reasoning is still using the analytical method in their approach. However, due to more experience than an advanced beginner they can recognise common patterns of differential diagnoses. The difficulty the competent practitioner faces are becoming overwhelmed by the increased responsibility of making decisions and the complexity of the uncommon cases. A key difference between an advanced practitioner and a competent practitioner is that the competent practitioner is invested in improving their future clinical reasoning by reflecting on mistakes when they are made and develop a deeper understanding of clinical practice (Carraccio et al., 2008).

An implication for teaching and learning for the competent practitioner is to be supervised by a clinical teacher. The teacher needs to balance their supervision so that the learner is

encouraged to make appropriate decision making on their own so they can learn the necessary skills to develop their clinical reasoning into intuitive pattern recognition and be accountable for their decisions (Carraccio et al., 2008). The proficient practitioner can use their experience to be efficient and effective in their clinical practice. However, what separates the proficient practitioner from the expert is that the proficient practitioner may recognise diagnoses and patterns associated with them but limited in the experience with the outcomes of the different possible management plans. Therefore the proficient practitioner still needs to use conscious decisions with their clinical reasoning for difficult clinical cases (Carraccio et al., 2008).

An implication for teaching and learning for the proficient practitioner is to be mentored by an expert and focus on developing their intuitive clinical reasoning. An expert has an immediate intuitive response to clinical reasoning and autonomic with their pattern-based recognition, unless faced with an unexpected case. Due to the constant automaticity it can be detrimental in the performance of an expert as their desire to learn and improve will decrease (Carraccio et al., 2008). An implication for teaching and learning for an expert is to remain challenged in order to be committed to reflective and lifelong learning (Carraccio et al., 2008).

The problem faced in an Osteopathy Teaching Clinic

Anecdotal evidence suggests that there are misinterpretations of injuries in the new patient history that meet ACC's criteria for lodging an injury claim. Student osteopaths in the Osteopathy Teaching Clinic could be making clinical errors and incorrectly claiming, or not claiming, for injuries. If a patient has had an injury that satisfies the criteria for injury cover healthcare providers can make an ACC claim (Accident Compensation Corporation, 2019b). A claim ensures that patients have access to the first and second entitlements for a claim, such as the costs for treatment and rehabilitation and loss of earnings if they are unable to work (Bismark & Paterson, 2006). The costs of private treatment can be high and put a financial burden on patients. However, if a claim is able to be made it can cover the cost for diagnostic modalities that can ensure appropriate treatment and management plans can be made. Accurate claims need to be made by musculoskeletal practitioners as it can facilitate the rehabilitation process. In the Osteopathy Teaching Clinic, the students start in the stage of learning as a novice practitioner and develop through the Masterate program into an

advanced beginner, where clinical errors of this type are more common. Therefore, an investigation is needed to assess if the quality of care for patients can be improved.

Previous research

Searches of related keywords have failed to identify any previous research or literature on a clinical audit in an osteopathy student clinic.

Clinical Audit

A clinical audit would be an effective way to identify the extent of clinical errors in an Osteopathy Teaching Clinic and provide information surrounding the need to improve or maintain current teaching practices. A clinical audit is a process that uses a systematic review against explicit criteria to identify a problem, implement a change and improve quality of care (University Hospitals Bristol, 2009). The difference between a service evaluation and a clinical audit it that a service evaluation answers the question, "what standard does this service achieve?" Whereas a clinical audit is a way to identify whether the standards of best practice are being met. Therefore, a clinical audit answers the question, "does this service reach a predetermined standard?" (Central and North West London NHS Foundation Trust, 2019, p. 1). Problems associated with clinical audits include hostility between some clinicians who criticise its use as a means of intimidation and ridicule (Johnston, Crombie, Davies, Elder, & Millard, 2000). In the case of the problem faced here, rather than asking student osteopaths and clinical tutors if about their claiming process, anonymising patient files and investigating the problem eliminates any hostility and ensures the effectiveness on improving quality of service for patients. Clinical audits are a necessary process to ensure attention is placed on continuous quality improvement in clinical practice (Esposito & Canton, 2014). Clinical audits typically follow a five-step cyclical process.

1. The first step is to identify a problem. Based on anecdotal evidence in the Osteopathy Teaching Clinic a problem was identified and will be discussed in this thesis.
2. The second step is to have a set of criteria and standard that the clinical practice can be compared to. Criteria in healthcare is defined as a measure that describes quality of care and are outcomes that are going to be measured (Esposito & Canton, 2014). In this thesis the criteria are supported by the ACC Treatment Provider Handbook which is the guidelines that should be followed when making an injury claim in clinical practice.

3. The third step is to collect the data to be audited. In this thesis past clinical records were audited, patient privacy was protected by anonymising files and there was no direct involvement to patients themselves.
4. The fourth step is to analyse the data and implement a change. This process involves comparing data audited from clinical records and comparing with the criteria and standard from step two. Results from this process are then analysed and a discussion of the problem, including intervention strategies takes place.
5. Lastly, step five is a monitoring of the implemented strategies to identify any improvements to clinical practice (Esposito & Canton, 2014).

Conclusion

In conclusion, musculoskeletal injury, disorders and pain are a burden to society and can cause disability preventing the ability to work and continue normal daily activities. An insurance scheme has been set up in New Zealand, called ACC, to compensate for the costs of treatment and rehabilitation from musculoskeletal primary healthcare providers, such as osteopaths. In the Osteopathy Teaching Clinic, students can make claims if the patient meets ACC criteria. However, the level of skill in a teaching clinic can predispose clinical errors such as oversight of ACC claims. This can prevent the patient from being offered the funding for quality healthcare they are entitled to.

The proposed study aims to investigate the extent to which new patient files in the osteopathy teaching clinic satisfy ACC's criteria for an injury claim. The study focuses on performing a clinical audit on an Osteopathy Teaching Clinic to investigate whether information recorded in the clinical notes would satisfy an ACC claim criteria for rehabilitation cover, that have not already been claimed for. As stated in this literature review a clinical audit similar to this has not been recorded in research databases and will provide some foundation insight into whether a problem may or may not exists. This data can be used to implement further changes to improve clinical practice in the future if found to be necessary.

Introduction

The Accident Compensation Corporation (ACC) is a 'no-fault' insurance scheme that provides funding for rehabilitation, and other forms of compensation, for all New Zealand citizens if they are injured in an accident (Accident Compensation Corporation, 2019a). This scheme means that, by legislation, the cost of treatment and rehabilitation is reimbursed regardless of what was happening or who was at fault (Accident Compensation Corporation, 2019a). Eligible healthcare practitioners such as medical practitioners, physiotherapists, osteopaths and other providers are able to lodge claims for ACC cover on behalf of patients.

When a patient has an injury, a health provider should be making an ACC claim if it satisfies the criteria for cover. This ensures the patient has access to ACC funding for treatment and rehabilitation costs, and helps ensure access to appropriate health care services. It is emphasised by ACC in The Handbook to have clinical notes that shows the history obtained, the examination procedures, how a diagnosis is formulated and the treatment and management plan (Accident Compensation Corporation, 2019a). ACC also have procedures to investigate and control for fraudulent claims, wastage, and abuse of claims. Competency is important to develop in the Osteopathy Teaching Clinic. When training, claims need to be made appropriately to consolidate accurate learning and practices. Thus, when practitioners move into post-registration practice, they are more likely to avoid misinterpretation of eligibility in lodging ACC claims. Making a claim for ACC cover helps to support the patient through the rehabilitation process with treatment funding, and reduces work and financial stress that can be associated with recovery from injury. When eligible, patients are entitled to ACC funding for medical costs, transport, pharmaceuticals, surgery, rehabilitation services and other legislated compensation (Accident Compensation Corporation, 2019a). Medical expenses are often a point of financial stress when privately funded, and without a valid ACC claim, it is likely that many people would experience financial stress. Furthermore, severe injuries may prevent the patient from working in paid employment for a period of time during recovery, and this can further aggravate financial stress. Weekly compensation for lost earning is supported by ACC which helps to minimise personal financial loss for the patient (Accident Compensation Corporation, 2019a). Patients are entitled to partial or full reimbursement of medical costs, transportation support, pharmaceuticals, surgery, rehabilitation services and other compensations.

The major facilitator of referral in New Zealand is ACC, and osteopaths are required to satisfy ACC criteria for any injury claims. The role of ACC is to work together with health professionals, registered as providers with ACC, who provide the treatment and rehabilitation services for patients to ensure that they receive the rehabilitation needed to return to work and activities of daily living after injury (Accident Compensation Corporation, 2019a).

In New Zealand, osteopathy qualifications are offered in Auckland, at 'Unitec' Institute of Technology, and Ara Institute in Christchurch. At Unitec, students first undertake undergraduate study in basic health sciences including anatomy, physiology, pathology, and osteopathic principles and clinical techniques culminating in award of a Bachelor of Applied Science (Human Biology). Students then enroll in a Master of Osteopathy programme, including 1000 hours of supervised clinical practice at a teaching clinic located on campus (Unitec Institute of Technology, 2018). All students working in the teaching clinic are supervised by clinical tutors, who are qualified and experienced osteopaths, who facilitate the development of students' clinical reasoning skills and practical clinical skills to support meeting the competency standards required for award of the degree and professional registration.

Anecdotal evidence, from senior clinical tutors working in the clinic, suggests that the clinical history for new patients' injuries were, on occasion, being misinterpreted and subsequently not satisfying ACC's criteria for lodging a claim. Therefore, the aim of the study was to investigate the extent to which new patient files in the osteopathy teaching clinic satisfy ACC's criteria for an injury claim.

Methods

Design

The study design was a clinical audit following the steps outlined by Esposito and Canton (2014) who identify five steps in the audit cycle. A clinical audit is a process designed to "improve quality of patient care and outcomes through a systematic review of care against explicit criteria, and guide the implementation of change" (University Hospitals Bristol, 2009, p.1). A clinical audit involves a stepwise process shown in a clinical audit cycle by Esposito and Canton (2014) (see Figure 1). The ACC Treatment Provider Handbook was used to inform construction of an algorithm to assess patient records to establish the extent to which ACC guidelines for claim eligibility were being met in the osteopathy teaching clinic (Accident Compensation Corporation, 2019a).

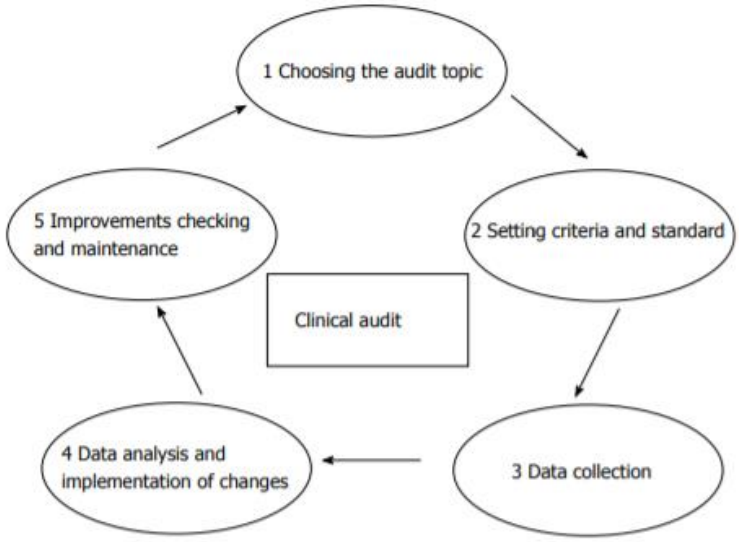

Figure 1. Clinical Audit Cycle (Reproduced from Esposito & Canton, 2014)

The criteria and standards (Step 2) were set using the ACC guidelines for health service providers. The current clinical practice was compared to these guidelines which are summarised in the ACC Treatment Provider Handbook (Accident Compensation Corporation, 2019a). In clinical audit, a problem checking and maintenance can take place. In this study, Step 4- the implementation of changes and Step 5- improvements checking and

maintenance (see Step 5 in Figure 1.) were not included as it was too early to confirm an existing problem, and are addressed in the discussion (Esposito & Canton, 2014).

The Handbook explains the criteria for identifying what conditions and injuries are eligible for cover, and therefore guides primary healthcare service providers in lodging claims on their patients' behalf. Physical injuries are a common presentation by patients consulting student osteopaths in the teaching clinic. A physical injury is described by ACC as "actual damage to your body" (Accident Compensation Corporation, 2017, p.1). The criteria from The Handbook were used to inform the development of a systematic structured algorithm to process each of the sampled files and determine claim eligibility status (Accident Compensation Corporation, 2019a).

Algorithm development

The criteria from The Handbook was used to develop an algorithm (Accident Compensation Corporation, 2019a). The algorithm was useful for the inclusion process as it could be replicated for each patient file that was pulled from file storage (see Figure 4). The difficulty faced was presenting the information from the guidelines in a systematic and structured way to streamline the data collection process. Both the inclusion and exclusion criteria were included in the same algorithm for this reason. Pilot testing worked to refine the algorithm to formulate a systematic structured algorithm. Refer to Appendix A for the developmental sequence of the algorithm that was used in this study.

Objectives

The primary objective was to identify the distribution of cases categorised within the contingency table (see Figure 1) of ACC claim criteria (met, not met) and whether there was an ACC claim (made, not made).

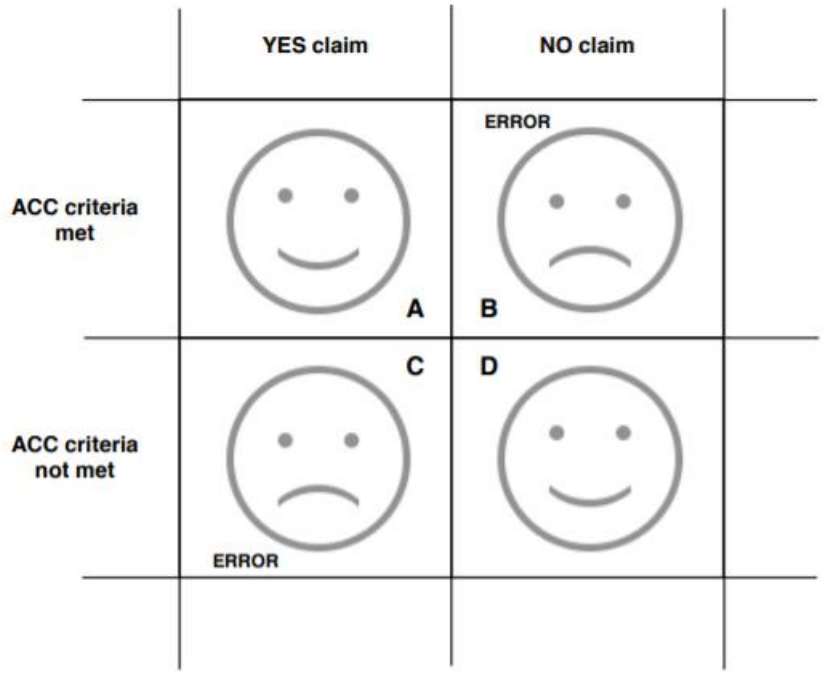

Figure 2. showing a contingency table (A= claim made, ACC criteria met; B= claim not made, ACC criteria met; C= claim made, ACC criteria not met; D= claim not made, ACC criteria not met).

Specific objectives were:

a. To identify the frequency of cases that were categorised within the contingency table of ACC claim criteria (met, not met) and whether a claim was made (made, not made) (Figure 1)
b. To compare the error frequency between months for 2016 and 2017
c. To compare the error frequency between years for 2016 and 2017
d. To compare the error frequency between Year 1 and Year 2 MOst students
e. To compare the error frequency between ACC read codes

Ethics

Consideration of ethical issues was based on the Unitec Research Ethics Guidelines under the 3.6 Exceptions from Approval Requirements, it is stated that "a) research that does not involve humans or animals and is not foreseen to adversely affect humans or animals" does not require approval from UREC (Rangahau, 2014, p.7). Therefore, a request to UREC was made to clarify the ethical status of this project and the exception was confirmed.

Sampling

A random sample of new patient files (operationally defined as those attending the clinic for the first time) was drawn from the pool of all clinical records between 1st January 2016 to 31st December 2016 and 31st December 2017. In this timeframe there were a total of 1168 new patient consultations. A proportional approach to sampling was used so that the number of files to be reviewed in each calendar month in the sample was proportional to the total of new patients for that year, relative to the proportion of total sample size to be randomly selected. An online margin of error sample size calculator (Survey Monkey, 2019, USA; https://www.surveymonkey.com/mp/sample-size-calculator/) was used to calculate the minimum sample size of n=290 files, based on a population n=1168, confidence level 95%, and acceptable margin of error 5%.

Refer to table 1 for the calculations for the number of cases required for 2016 and 2017 proportional to the total number of patients for the year and month.

Table 1

Proportional sampling for each calendar month

	2016				2017		
Month	NP (n)	Proportion Month	No. to randomly sample		NP (n)	Proportion Month	No. to randomly sample
Jan	44	0.070	11		36	0.066	9
Feb	33	0.053	8		31	0.057	8
Mar	76	0.121	19		55	0.101	14
Apr	72	0.115	18		44	0.081	11
May	61	0.097	15		43	0.079	11
Jun	61	0.097	15		58	0.107	14
Jul	52	0.083	13		45	0.083	11
Aug	43	0.069	11		59	0.109	15
Sep	75	0.120	19		58	0.107	14
Oct	54	0.086	13		40	0.074	10
Nov	40	0.064	10		45	0.083	11
Dec	15	0.024	4		28	0.052	7
Subtotal	626				542		
Total N (2016 + 2017)	1168						
Overall sample size (from margin of error calculation)	290						
Sample Size (from margin of error calculation)							
2016	0.54	156					
2017	0.46	134					

Note. The table shows the frequency of new patients each month and the total number of new patients for dates between 1st January 2016 to 31st December 2016 and 1st January 2017 to 31st December 2017. It also shows the process of calculating the proportion to be randomly selected for data collection for each month.

Procedures

Figure 2 shows the series of processes that needed to be performed in order to reach the final outcome for data collection. These were: a process for pulling the file, anonymising process, inclusion process and then review process.

1. Pulling the file process:
   - Calculated the number of files to be reviewed in each calendar month so the sample was proportional to the total of new patients for that year relative to the proportion of total sample size to be randomly selected (see Table 2)
   - Anonymised the files before randomly selecting them for audit
   - Randomly selected files with a random number generator
2. Anonymising process:
   - File was anonymised once pulled from file storage before determining whether it met the inclusion criteria
3. Inclusion process:
   - Constructed a set of criteria from ACC guidelines to be used with new patient case history to include or exclude files for review
   - Compared the criteria with a new patient notes for inclusion or exclusion
   - If excluded from the audit, this was not included in the total number of files
   - If included, added the file to the total number of files for review until n=290
4. Review process:
   - Reviewed the new patient files to determine whether ACC's criteria for an injury claim was met

Pulling the file and anonymising process

The pulling the file and anonymising process is shown in Figure 3. The sample selection was randomised using a random number generator on the random.org website.

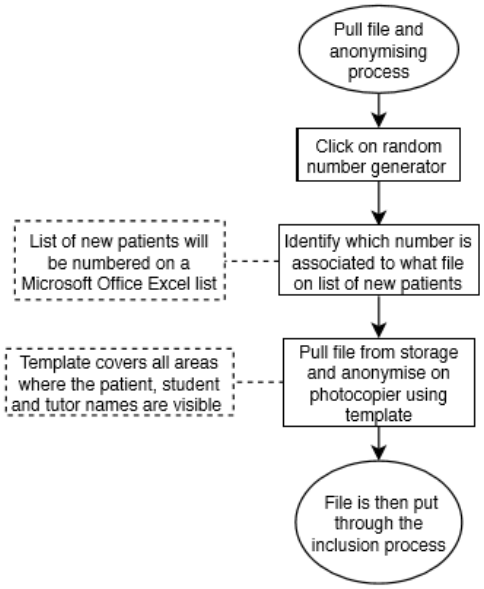

Figure 3. Pulling the file and anonymising process flow chart. "Random number generator= using the online Research Randomizer on random.org; Template= card that is placed over the new patient file that covers private information; Inclusion process= ACC criteria algorithm"

Inclusion process

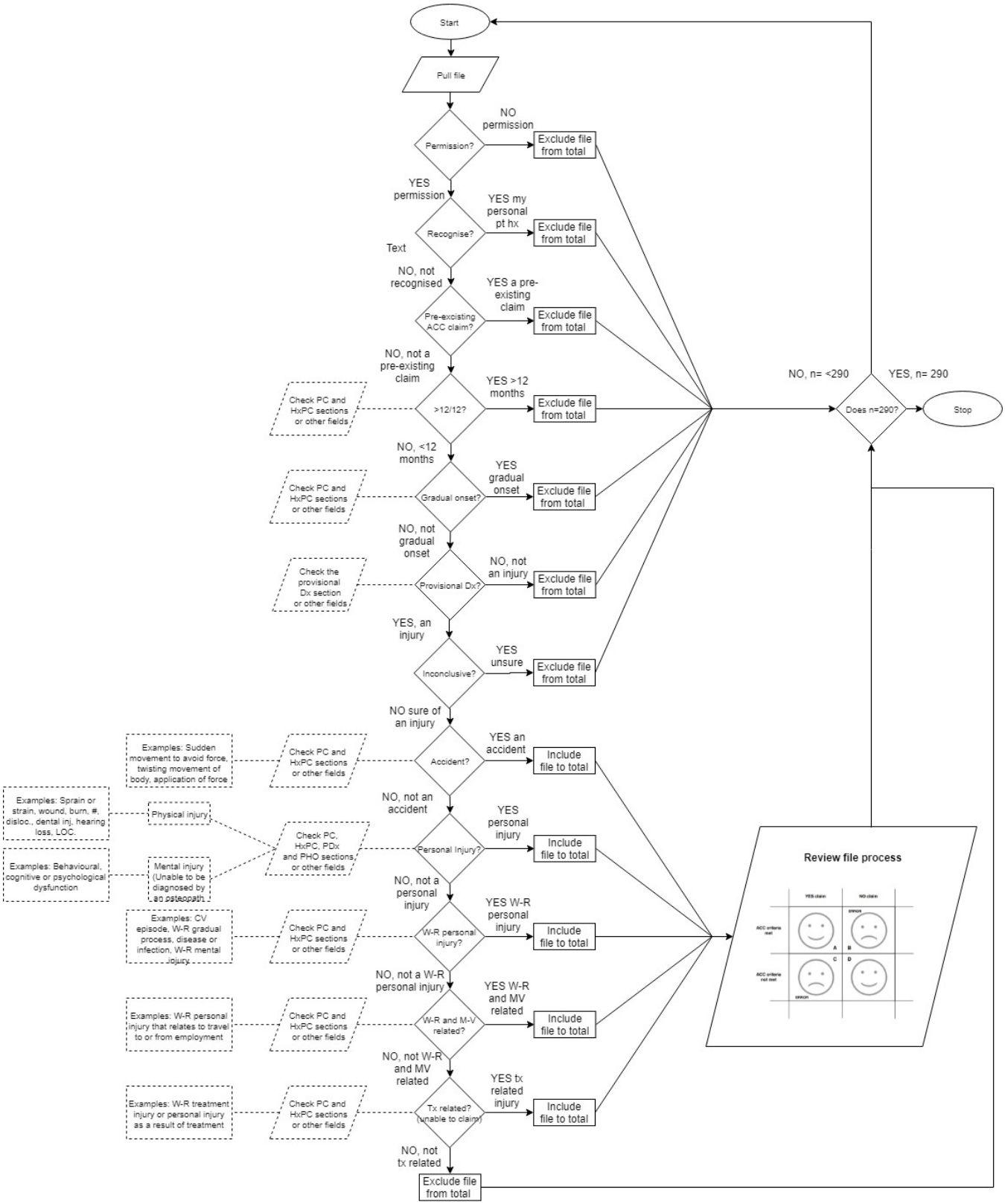

Figure 4. ACC criteria algorithm. “Permission= is there permission to use the patient's file for research?; Recognise= did I recognise this file as my own personal patient hx?; Pre-existing ACC claim= is it a pre-existing ACC claim?; >12/12=was the date of onset >12 months; Gradual onset= is it a gradual onset injury?; Provision diagnosis= is it a gradual onset injury?; Accident= did the injury match ACC description of an accident?; Personal injury= did the injury match ACC definition of a personal injury?; Work related personal injury= is it a work-related personal injury?; Work related and motor vehicle= was the injury work related and motor vehicle related?; Treatment related= is it a treatment related injury? (Unable to be claimed by an osteopath); Inconclusive= am I inconclusive whether to review this file?”

Review process

The review process was to categorise a given case into one of four outcomes as shown in Figure 2. The outcome from this process was used in data collection and analysis.

Data analysis

Raw data was extracted from each of the sampled patient files and tabulated in excel. Data was then categorised into 2x 2 contingency tables (see Figure 2.). The read codes for the cases distributed into the contingency table category B were determined by the ACC criteria algorithm and list of read codes. Accuracy statistics were generated using an online statistics application (MedCalc, Acacialaan 22, Belgium; https://www.medcalc.org/calc/diagnostic_test.php). In order to aid interpretation 95% confidence intervals was calculated for each of the accuracy statistics. The formula to calculate accuracy was: accuracy = a + d / a + b + c + d (Sackett, 1991). To address objective a, an overall contingency table was constructed and accuracy statistics with confidence interval was calculated. To address objective b, a scatter plot was constructed for the accuracy distribution between months for the time frame and linear regression line of best fit was determined. To address objective c, two contingency tables were constructed for 2016 and 2017, accuracy statistics with confidence intervals was calculated to compare years. To address objective d, contingency tables were constructed for Year 1 and Year 2 MOst students and accuracy statistics with confidence intervals calculated. Then, the data was separated into 2016 Year 1 Most students and 2017 Year 2 Most students to follow the same group across the Master of Osteopathy program. A scatter plot was constructed for the accuracy distribution following the same group of students for the time frame and linear regression line of best fit was determined. To address objective ‘e’, the contingency table of the overall data was used to tabulate the cases that were distributed into category ‘B’. These cases and the read codes associated with them were adjusted for prevalence in comparison to the number of claims and corresponding read code in the osteopathy teaching clinic within the same time frame.

Results

a. To identify the distribution of cases that are categorised within the contingency table of ACC claim criteria (met, not met) and whether a claim was made (made, not made) (Figure 2)

Of the 1168 files retrieved from the database, 290 were randomly selected and analysed for the period 1st January 2016 to 31st December 2017. There was a total of 509 files that did not meet the inclusion criteria and were excluded from the sample, 275 from 2016 and 234 from 2017. Table 3 shows the contingency table for the overall sample that was analysed. The total sample size (n=290) consisted of 53.8% patient files from 2016 and 46.2% from 2017. Overall, of the total patient files, 29.7% a claim was not made when it met ACC criteria for an injury claim. Overall, the accuracy was 70.3% (95%CI 64.7-75.5%).

Table 3

Contingency table of the overall total patient files

2016 and 2017 Total			
	Claim made	Claim not made	Total
ACC criteria met	59	86	145
ACC criteria not met	0	145	145
Total	59	231	290

b. To compare the accuracy between months for 2016 and 2017

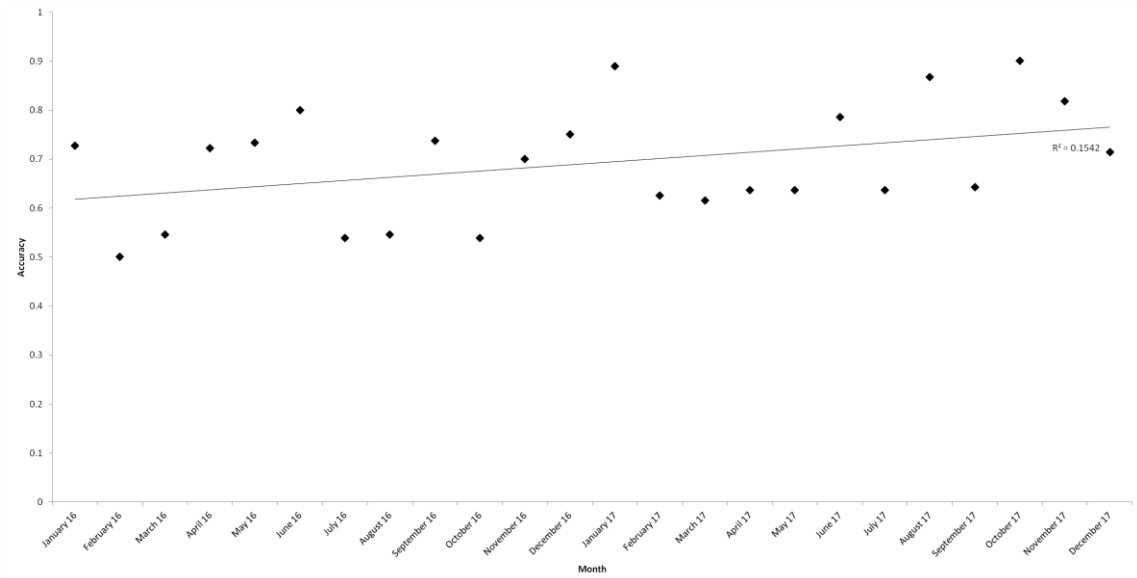

Figure 5. Accuracy for each of the months in January 2016 to December 2017.

Figure 5 shows the accuracy for each of the months in the period January 2016 to December 2017. Overall, the mean accuracy over the period was 69.2% (95%CI 67.6-70.8%). On visual inspection, accuracy appears to be unrelated to time as suggested by linear regression (R^2 = 0.15).

c. To compare the accuracy between 2016 and 2017

The contingency table for 2016 (n=156) displayed in Table 4 shows that 50 new patient files met the ACC criteria for injury, however, a claim was not made (32.0%); this represents an accuracy of 67.9% (95%CI 60.0-76.2%). In comparison to 2017 (n=134), (Table 5) there were 36 new patient files that met the ACC criteria for injury, however, a claim was not made (26.9%); this represents an accuracy of 73.1% (95%CI 64.8-80.4%). In Table 4 and 5, the accuracy is on the side of favouring underclaiming (claim not made when ACC criteria met), and there are no instances of overclaiming (claim made when ACC criteria not met).

Table 4

Contingency table of the overall patient files for 2016

2016 Total			
	Claim made	Claim not made	Total
ACC criteria met	30	50	80
ACC criteria not met	0	76	76
Total	30	126	156

Table 5

Contingency table of the overall patient files for 2017

2017 Total			
	Claim made	Claim not made	Total
ACC criteria met	29	36	65
ACC criteria not met	0	69	69
Total	29	105	134

d. To compare the accuracy between 1st year and 2nd year MOst students

Of the total sample (n=290) 134 out of 290 (46.2%) were patient files associated with consultations made by Year 1 MOst students, and 156 out of 290 (52.8%) were associated with Year 2 consultations. Table 6 displays the contingencies for files across both 2016 and 2017 associated with Year 1 MOst consultations (n=134); here, 40 out of 134 (29.9%) new patient files met the ACC criteria for injury and a claim was not made, with an accuracy of 70.1% (95%CI 61.6-77.7%). Similarly, Table 7 shows the contingencies for the Year 2 MOst student consultations (n=156). For the Year 2 consultations, there were 46 out of 156 (29.5%) new patient files that met the ACC criteria for injury and a claim was not made, with an accuracy of 70.5% (95%CI 62.7-77.5%).

Table 6

Contingency table for the overall patient files for 2016 and 2017 Year 1 Most students

2016 and 2017 Year 1 Most Total			
	Claim made	Claim not made	Total
ACC criteria met	24	40	64
ACC criteria not met	0	70	70
Total	24	110	134

Table 7

Contingency table for the overall patient files for 2016 and 2017 Year 2 Most students

2016 and 2017 Year 2 Most Total			
	Claim made	Claim not made	Total
ACC criteria met	35	46	81
ACC criteria not met	0	75	75
Total	35	121	156

d. To compare the accuracy following a group of 1st year into 2nd year MOst students

Following the same group from 2016 Year 1 MOst students into 2017 Year 2 MOst students, variation in accuracy over time was explored. Of the 2016 and 2017 Year 1 Most total 61 out of 134 (45.5%) were 2016 Year 1 Most patient files. The contingency table for 2016 Year 1 MOst (n=61) in Table 8 showed that 18 out of 61 (29.5%) new patient files met the ACC criteria for injury and a claim was not made, with an accuracy of 70.5% (95%CI 57.4-81.5%). Of the 2016 and 2017 Year 2 Most total 61 out of 156 (39.1%) were 2017 Year 2 Most patient files. In comparison to 2017 Year 2 MOst (n=61) in Table 9 there were 14 out of 61 (23.0%) new patient files that met the ACC criteria for injury and a claim was not made, with an accuracy of 77.0% (95%CI 64.5-86.9%). As the confidence levels overlap (57.4-81.5% and 64.5-86.9%) no difference in accuracy was identified over time.

Table 8

Contingency table for the total from 2016 Year 1 MOst students.

2016 Year 1 Most Total			
	Claim made	Claim not made	Total
ACC criteria met	8	18	26
ACC criteria not met	0	35	35
Total	8	53	61

Note. This was following the same group of Year 1 MOst students in 2016 to Year 2 MOst students in 2017.

Table 9

Contingency table for the total from 2017 Year 2 MOst students.

2017 Year 2 Most Total			
	Claim made	Claim not made	Total
ACC criteria met	13	14	27
ACC criteria not met	0	34	34
Total	13	48	61

Note. This was following the same group of Year 1 MOst students in 2016 to Year 2 MOst students in 2017.

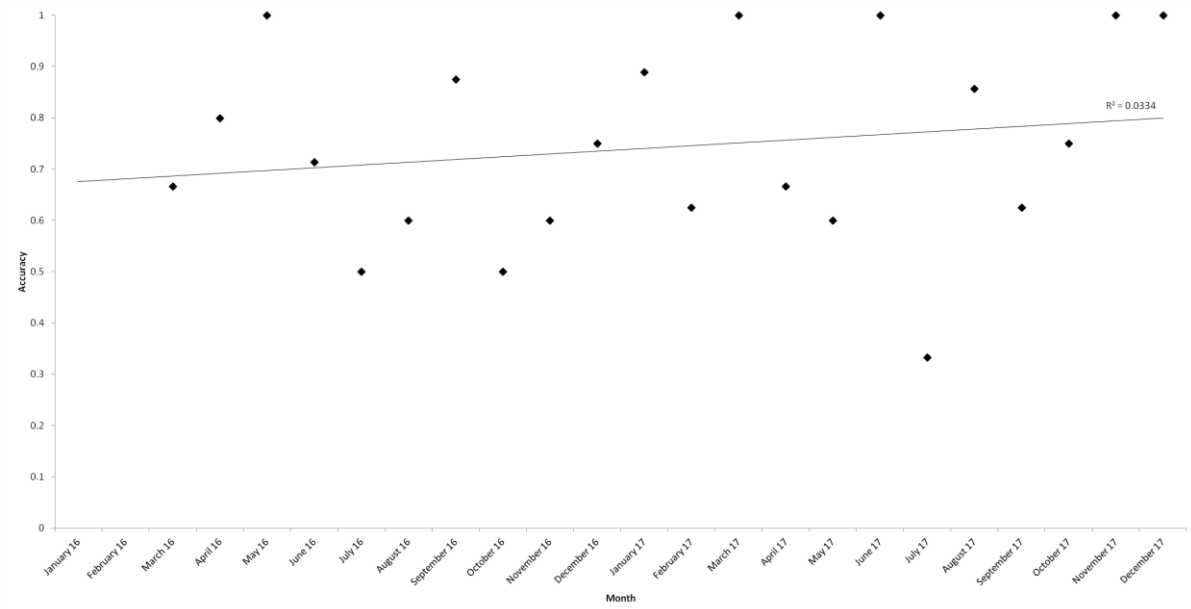

Figure 6. Accuracy for each of the months in the period from 1st January to 31st December 2016 (1st year MOst) and from 1st January to 31st December 2017 (2nd year MOst) following the same group.

Figure 6 shows the accuracy for each of the months in the period from 1st January to 31st December 2016 (Year 1 MOst students) and from 1st January to 31st December 2017 (Year 2 MOst students) following the same group of students. Overall, the mean accuracy over the period was 74.3% (95%CI 71.6-77.1%). It can be seen by the linear regression that there is substantial variability over time (linear R^2 is 0.03).

e. To compare the error distribution between ACC read codes

Table 10

Total sample collected and total number of ACC claims 2016/2017 between all body regions for claims that met ACC criteria and a claim was not made

Region	Sample collected	Total number of ACC claims 2016/2017
Lumbosacral	38	91
Neck	16	43
Hip & Thigh	15	16
Shoulder & Arm	14	29
Knee & leg	11	13
Thoracic	8	31
Rib	5	6
Ankle & Foot	4	17
Elbow & forearm	2	7
Wrist & hand	1	14
Total	114	267

Table 10 shows the error distribution for different regions derived from the ACC read codes. From the sample 114 files met ACC criteria and a claim was not made. The sample was compared with the claims made between 2016 and 2017 (267).

Table 11

Error prevalence between the major body regions for claims that met ACC criteria and a claim was not made for specific body regions

Region	Sample collected	Total number of ACC claims 2016/2017	Prevalence
Lumbosacral	38	91	29%
Neck	16	43	27%
Hip & Thigh	15	16	48%
Shoulder & Arm	14	29	33%
Knee & leg	11	13	46%

Table 11 shows the sample collected adjusted for the prevalence between the specific body regions by dividing the sample collected by the sample collected plus the total number of ACC claims 2016/2017.

Discussion

Key Findings

There are three key findings of the study. The first key finding showed that approximately one-third of all new patient consultations appear to be underclaimed, based on the presence of information recorded in the clinical notes. The second key finding supported an absence of overclaiming, when injuries did not meet ACC criteria. The third key finding suggested that claiming accuracy was variable.

1. Underclaiming

Psychological stressors and cognitive fatigue are two possible reasons for the resulting errors found in the current study auditing the student clinic. Stress has been shown to be both a negative contributing factor, causing error, and an enhancing factor, providing clarity, in determining the influencers of clinical errors. In one study, stress was shown to have a moderate impact on mistakes being made in a clinical environment (LeBlanc, McArthur, King, MacDonald, & Lepine, 2005). Whereas, in another study, stress was shown to improve the students fundamental technical skills (LeBlanc et al., 2008). These contradicting findings suggest that stress presents as a possible variable in the incident of human error, but is not a sole contributor for the mistakes made by novices or training osteopathy students.

A correlation between the impact of acute stressors on clinical performance and clinical performance in a clinical environment has been shown in a review paper by LeBlanc (2009). Tasks that require multitasking, working and retrieval of information from memory, and decision making are hindered by elevated stress levels (LeBlanc, 2009). From the experience of being a student trained in the clinic, the environment can be viewed as stressful when learning new skills and applying them in action. Stress has been shown by (LeBlanc, 2009) to negatively influence the ability for novice practitioners to maintain accuracy and this has the potential to contribute to human errors or poor judgement outcomes. Therefore, it is important for students to develop skills in monitoring their stress, and improving their stress management skills to reduce potential errors from arising. Scott's (2009) study supports the need to develop stress coping skills through professional development programs that expand clinical expertise and self-reflection and feedback. Professional development has been supported as an effective way to improve a novice practitioner's accuracy and has worked to minimise the instance of human error.

Students training in the clinic are in a dual role. Students are treating patients from the community, whilst also having to undertake exams, complete assignments, attend lectures, and undertake practical skill evaluations. This full-time academic scheduling can lead to cognitive fatigue as the direct result of prolonged effort, challenging mental exertion, challenging physical exertion and acute but sustained mental effort (DeLuca, 2005). Cognitive fatigue is defined as poor performance caused by loss of attention and motivation (Holtzer, Shuman, Mahoney, Lipton, & Verghese, 2011, p.1). Cognitive fatigue is observed by a decrease in practitioner performance, and the subsequently an increase in occurrence of clinical errors (Holtzer et al., 2011). Fatigue is supported to contribute to medical errors in a clinical setting and has cognitive and physical components (Holtzer et al., 2011; Jha et al., 2001). It is possible that cognitive fatigue is linked to what is experienced by novice practitioners, alongside long working hours and poor sleep hygiene, and presents a possible reason for the results of this study (Jha et al., 2001).

2. Overclaiming

The sample group correctly identified when claims were not meeting ACC criteria for an injury claim, which is a positive result for the osteopathic clinic investigated. A point that may explain this is the meticulous approach of the students as novice practitioners, hypothetico-deductive reasoning is the predominant clinical reasoning method to seek a diagnostic conclusion (Roots, 2014). As the students are in a training clinical environment, every new patient is treated as a new learning experience. The collaboration with tutors ensures the patient receives a thorough examination, diagnosis and management plan for their treatment (Carraccio et al., 2008). The presence of hypothetical-deductive reasoning, highly concentrated focus on individual patients, and close support of the supervising osteopath provides an environment where overclaiming does not occur, aligning with the findings in this study.

Another possible reason overclaiming was not represented in this sample could be due the professional risk associated with making false or inaccurate ACC claims. Practitioners may hold the belief that failing to make an accurate ACC claim could be more accepted than instances of false or inaccurate claiming. The Handbook describes fraud as a dishonest claim (Accident Compensation Corporation, 2019a). For example, claiming for an injury that does not meet the criteria as accidental. Such examples include claims for congenital defects, age-related degenerative disease, or other disease (Accident Compensation Corporation, 2019a).

Not all inaccurate claims are classed as 'fraudulent' as in some instances ACC can decline to cover for an injury pending more information. It is possible that a student might avoid overclaiming to reduce the risk of being viewed as an incompetent student by their examiners, or in extremely rare cases, being subjected to investigations for fraud. This would also present with a range of complications for the Osteopathy Teaching Clinic. As a result of these factors, we may expect to find several cases that fall into the 'human error' category, but also the 'cautious trainee-practitioner' that avoids instances of making claiming errors. It is possible that a proportion of the underclaimed sample found in this study, may be represented in the category of students avoiding overclaiming.

3. Accuracy is variable

When following the same group of students from 2016 Year 1 Most to 2017 Year 2 Most, the results were not sufficient to show a linear increase in accuracy as values were too variable to detect a small correlation. Taie (2014) describes skill acquisition is a process of developing a skill over time. Clinical reasoning is a skill that students develop in the Osteopathy Teaching Clinic from a novice practitioner into an experienced practitioner. The general expectation when in a student clinic and learning environment is that people learn and get better over time. It is suggested by Benner, Hughes and Sutphen (2008) that fewer errors would be made as their pattern recognition improves and knowledge base grows. However, in the present study the results show that this may not be the case.

Error distribution between body regions

An interesting finding was the error distribution between body regions. A large proportion of lumbosacral cases are not being claimed when the patient meets ACC criteria in comparison to the other read codes. This is particularly important because ACC reports indicate that back and spine injuries are a significant portion of ACC claims (Accident Compensation Corporation, 2019c). During the period 2016-2017, there were on average 1.15 million new claims made each year (Accident Compensation Corporation, 2019d). Of those new claims 264,000 were back and spine related soft tissue injuries, and the associated treatment costs were approximately $343 million each year. ACC requires healthcare providers to establish a cause for the patient's pain with a diagnosis before outlining a treatment and management plan. However, unspecific low back pain can be difficult to reliably identify the pathology (Hall, 2014). A majority of low back pain cases could be due to minor mechanical dysfunction but quality of pain may not make it easy to determine the definitive diagnosis

(Hall, 2014). Therefore, it can be difficult to make an ACC claim for low back pain if it is non-specific with no definitive diagnosis and could be a reason behind the large proportion of lumbar sprains that were not claimed when they met the ACC criteria.

Patient's Perspective

From a patient's perspective, not having an ACC claim for their injury could mean missing out on support during their rehabilitation process. Without ACC support, treatment is self-funded and this could cause future implications, such as a patient being financially unable to afford future treatment, surgery, or diagnostic modalities. Being unable to access these services may impair rehabilitation. A longer rehabilitation process can cause negative outcomes for the community and family if a person is unable to return to work. ACC makes healthcare more accessible and the advice, treatment, and referral from healthcare professionals will provide better outcomes for rehabilitation and faster return to work and normal activity.

Strengths and Weaknesses

Strengths of this study were the vigorously documented algorithm criteria that were developed over a series of pilot studies (refer to appendix A through to F for algorithm development). The systematic criteria could be useful for clinical educators at Unitec who may want to replicate the study as an intervention with students to improve or monitor their clinical skills. Although a teleconference call with ACC to talk about the project and check on assumptions in the interpretation of criteria was made, it was logistically difficult and time consuming for a second assessor (Jonathan Paine, personal communication, April 4, 2018). Therefore, a weakness of the study is with the absence of an interpretation of ACC criteria guidelines from an ACC second assessor. It may have reduced possible bias if the data was compared with a second assessor from ACC to compare interpretations and findings. It was also difficult to group individual patient files into one specific region as some met ACC criteria for an injury claim across multiple regions.

Limitations

There are two main limitations of this study. The first is that the study is very limited to Clinic 41 Osteopathy student clinic until another student clinic opens in New Zealand (Ara Institute, Christchurch) and is not generalisable to general practice. It seems unlikely there is underclaiming in the commercial environment as practitioner clinical reasoning skills have

had the experience to develop and the chance of clinical errors has reduced (Roots, 2014). Lastly, the unique healthcare environment in New Zealand makes it difficult to generalise to other funding systems.

Implementations

The recommendations for use of this audit in future clinical practice, on a clinical scale, can be with other clinical professions. As mentioned in the limitations, until another teaching clinic in New Zealand for osteopathy opens it would be difficult to replicate and compare findings. However, expanding the scope of the audit to other musculoskeletal disciplines is a possibility. For example, physiotherapy has three teaching clinics in New Zealand (Auckland University of Technology Physiotherapy Degree, University of Otago Physiotherapy Degree and Waikato Institute of Technology Physiotherapy Degree), New Zealand College of Chiropractic and other musculoskeletal disciplines could have reason to replicate this audit to measure progress of student's accuracy overtime and to compare findings. Another implementation could be on an individual student by student scale, tutors can make use of the algorithm to review a student's new patient history notes in a form of monitoring. Both implementations are an option for educators to improve student's clinical skills.

Conclusions

In conclusion, a clinical audit was performed at an osteopathy student clinic, to investigate the extent to which new patient files in the osteopathy teaching clinic satisfy ACC's criteria for an injury claim. A series of processes were performed to collect the data for analysis such as, constructing an inclusion and exclusion criteria algorithm, randomly selecting and anonymising patient files, and reviewing patient files and categorising them into the four contingency table outcomes. In this sample, there was approximately 30% of underclaiming when a patient's injury meets ACC criteria for an injury claim. Also, no overclaiming when injuries did not meet ACC criteria. Finally, accuracy was variable when following the same group of students from 2016 Year 1 MOst to 2017 Year 2 MOst. A suggestion for further research is using modified or replicated methods of this audit to compare findings with another student clinic in New Zealand (such as at Ara Institute).

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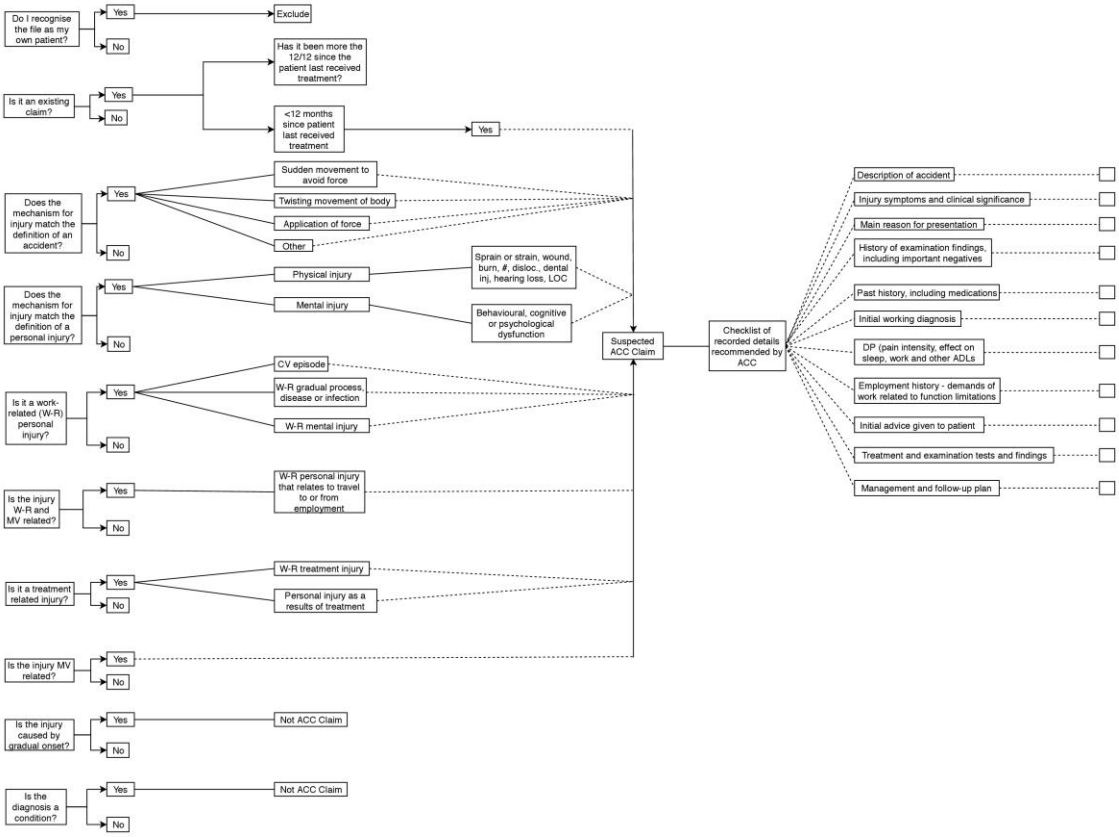
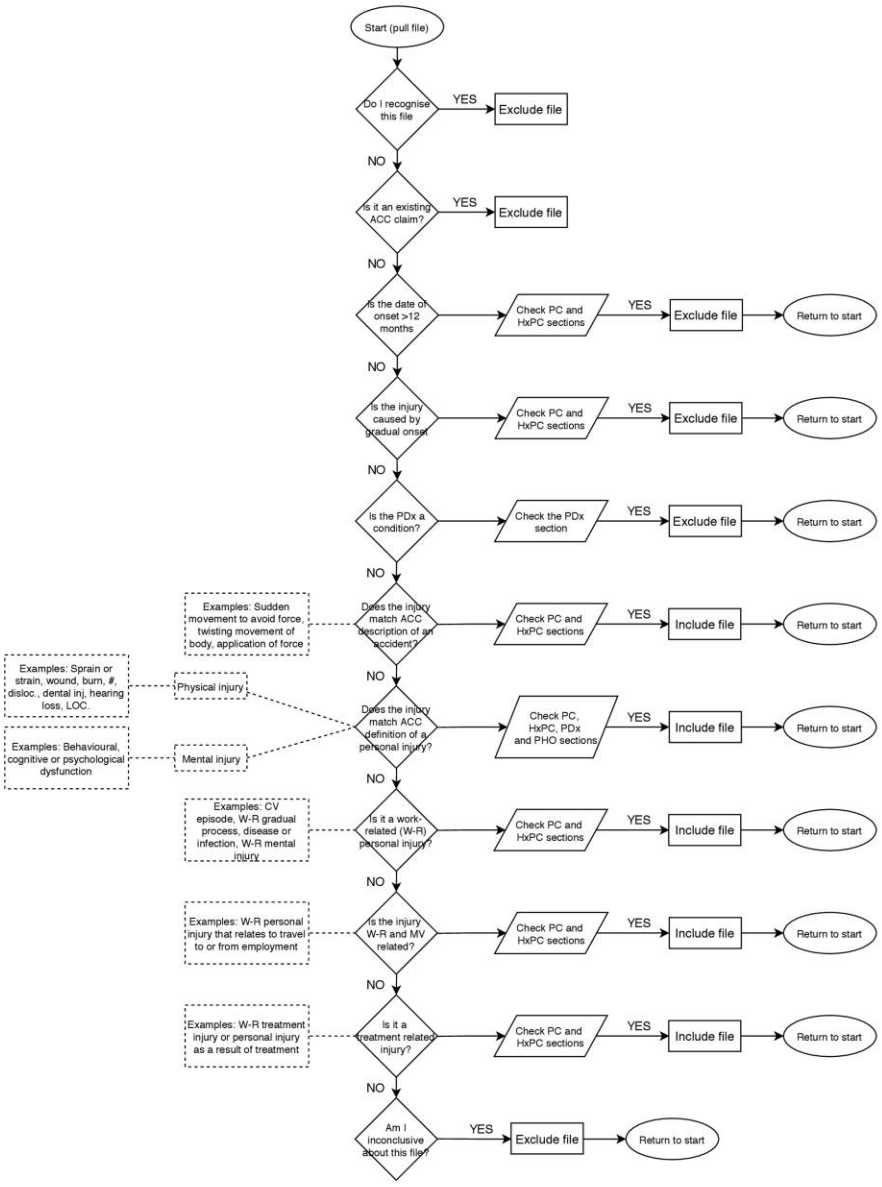
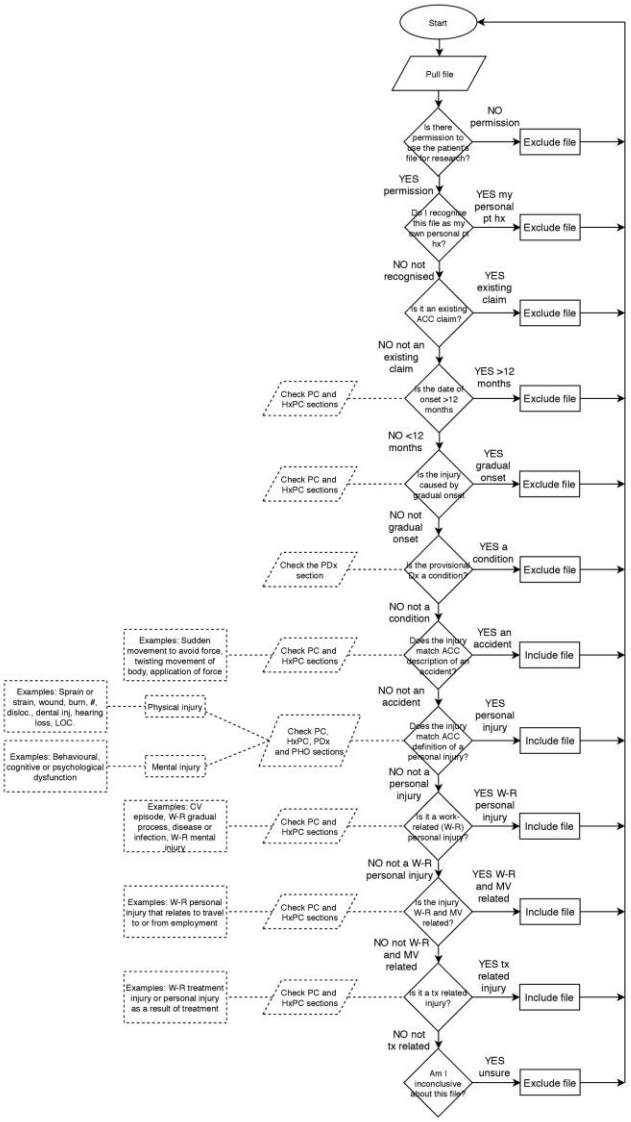
Appendix A: Sequence of algorithm criteria development 1



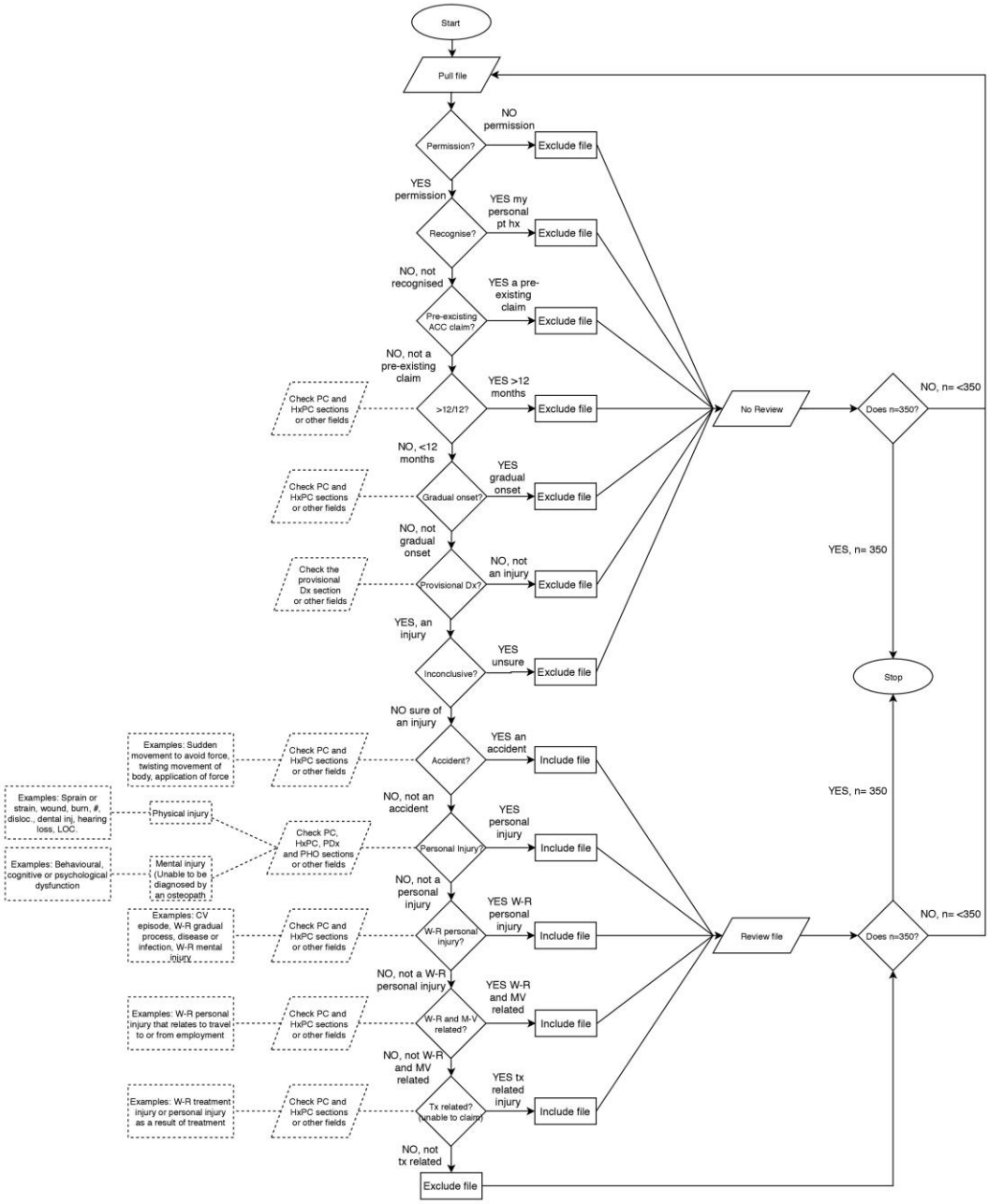
Appendix B: Sequence of algorithm criteria development 2



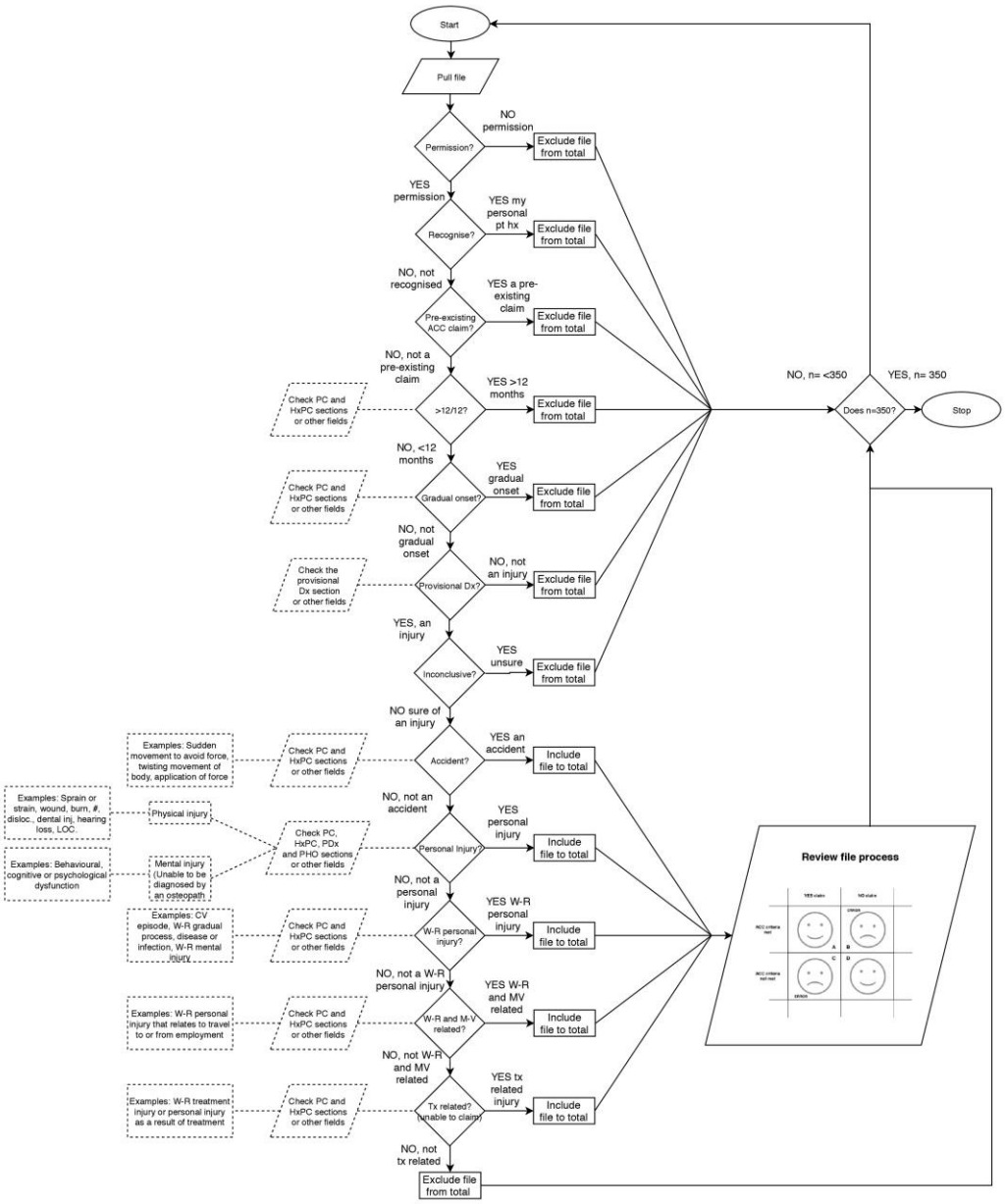
Appendix C: Sequence of algorithm criteria development 3



Appendix D: Sequence of algorithm criteria development 4



Appendix E: Sequence of algorithm criteria development 5



Appendix F: Sequence of algorithm criteria development 6