A QUALITATIVE INQUIRY ON COMPETITIVE FIGURE SKATERS' PERCEPTIONS OF CONCUSSION RISK AND INJURY PREVENTION

by

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DEDICATION

To God and the Catholic Church. Thank you for providing me spiritual support and hope during this journey of research. I will always remember St. Mary's Cathedral on Spring Garden in Halifax where I would go for evening mass.

To all the athletes who have suffered a concussion. Taking time off should not be a stigma, and choosing to play injured is something we all do. This is for those who are still facing challenges due to their condition, know someone who is struggling, or are the significant other of anyone facing a concussion. Discovering what can be done to make lives better and elongate careers is why I stay in research.

I also dedicate this research to my father, Dr. Scot J. Frost, who was my example of choosing player safety over everything else. He valued the quality of an athlete's life and his patients more than anything and taught me those same values. My father was a great lover of sport and health. He took me to the rink, encouraged me to try any winter sport, and I still look up in the stands in honor of him where he would sit with his books. His experiences with concussions, and recognizing when I had mine, are why I seek to create a safe sport environment for all.

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ABSTRACT

Concussion research in figure skating research is scarce. Using a qualitative, inductive, thematic analytical approach this project explored the experiences, perceived knowledge, attitudes, and beliefs of 19 current and former figure skaters towards concussion risk, prevention, and management. Three superordinate themes were identified: Concussion Consequences, Skating Safety Education and Awareness, and Risk Reduction. Overall, the study found that participants believe concussion risk to be moderate-to-high in competitive figure skating. While not all had suffered a concussion, most described a basic understanding of symptom awareness and long-term effects. Those participants who had knowingly suffered a sport-related concussion expressed varying beliefs and attitudes when it came to the use of protective equipment and risk reduction strategies. Results provide insight into how participant experiences influence knowledge, attitudes and beliefs towards perceived concussion risk and attitudes towards the need for use of protective equipment and risk reduction strategies. The findings highlight the need for effective preventive mechanisms for concussion risk reduction and athlete safety among competitive skaters.

Keywords: Figure skating, Concussion, Qualitative descriptive, Thematic analysis

LIST OF ABBREVIATIONS USED

TBI	Traumatic Brain Injury
CTE	Chronic Traumatic Encephalopathy
PCS	Post-Concussion Syndrome
CDC	Centers for Disease Control
APOE	Apolipoprotein E
LOC	Loss of Consciousness
SKiPS	Skater Injury and Prevention Survey
USFS	United States Figure Skating

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CHAPTER ONE: INTRODUCTION

It is estimated that 3.8 million sports-related concussions occur every year (Harmon et al., 2013) with as many as 50% going undetected and/or underreported (Meehan et al., 2013). While concussions are commonly associated with high impact contact sports, such as football, it is notable that only 300,000 concussions are estimated to be resulting from football-related traumatic brain injuries (TBIs) (Daneshvar, Nowinski, McKee, & Cantu, 2011b) with as many as 1.4 to 2.7 million sport-related concussions being caused by participation in other sporting and recreational activities. However, due to factors such as knowledge and reporting behaviors, the statistics of non-contact sport reporting for cohorts such as figure skating are unknown.

Concussions can result in athletes missing substantial playing time, and in extreme cases, concussive injuries and the lasting side-effects can force athletes to prematurely retire from their sport or become debilitated (Concannon et al., 2014; Ilie et al., 2018; Sedney et al., 2011, Ilie et al., 2018). While concussions are relatively common injuries that frequently co-occur with psychological distress and need for treatment, substance use and violent and non-violent conduct behaviours (Ilie et al, 2014; Ilie et al, 2015; Ilie et al., 2017). This rate is even higher for those who have experienced childhood trauma and/or mistreatment (De Beilis & Putnam, 1994). These associative effects may result in negatively impacting individuals' quality of life later on in adulthood, specifically poor quality of life, financial implications, as well as cases of post-traumatic stress (Ilie et al., 2018). Furthermore, there is a note of reduced cognition, lack of self-care, as well as social difficulties (Ilie et al., 2018).

While evidence on the exact rate of concussion-induced retirement is scarce, it is sufficiently prevalent that numerous guidelines have been developed to assist athletes with the often-distressing transition out of sport (Ilie et al., 2018). As such, many strategies target the emotional distress and potential depressive symptoms that prematurely retiring from a sport

may bring (Concannon et al., 2014; Davis-Hayes et al., 2018; Ilie et al., 2014). Furthermore, concussions are known to cause several off the field issues such as poor academic performance (Ilie et. al., 2020). In some cases, non-contact sports are suggested as an option for easing an athlete's transition out of a contact sport (Davis- Hayes et al., 2018), yet some non-contact sports may also pose a risk due to the functional mechanisms that are also known to increase concussion risk, such as falling and whiplash like movements. For example, baseball has been shown to pose a concussion risk for athletes who fall or dive to get to the ball (Williams, 2020). Similarly, non-contact competitive ice sports such as figure skating are known to put athletes at increased concussion risk due to an increased possibility of falling onto the hard ice surface. Unique to figure skaters is the added concussion risk associated with repeated spinning movements. Interestingly, while less recognized, concussions are one of the most frequent injuries skaters face (King et al., 2017). Despite these risks, perceived concussive risk from current and former competitive figure skaters is largely unknown. Thus, using a qualitative, inductive, thematic analytical approach the goal of this study was to gain an understanding of athlete experiences, knowledge, attitudes, and beliefs with respect to concussion risk, prevention, and management. In brief, this study generated important insight into how concussion risk is perceived in competitive figure skating and how risk might be mitigated.

CHAPTER TWO: LITERATURE REVIEW

Boxing was one of the first contact sports to be associated with a high risk of concussion and its associated complications (Jordan, 2013). Popular contact and collision-based sports such as football, soccer, ice hockey, rugby, and martial arts have also been shown to place their athletes at an increased concussion risk (Jordan, 2013). High-velocity sports such as motor racing, equestrian sports, roller skating, skiing, and cycling are likewise known to be associated with increased concussion risk (Jordan, 2013). Team sports such as football, hockey, lacrosse, wrestling, soccer, and basketball are the sports with the highest rate, apart from wresting (Ilie et al., 2020). Interestingly, an epidemiological study suggested that baseball, basketball, hockey, cheerleading, gymnastics, field hockey, lacrosse, volleyball, and wrestling should also be considered higher-risk sports and additional vigilance is warranted, as these athletes have been shown to be at risk of under diagnosis (Daneshvar et al.,2011a; Cusimano et al., 2013).

With a growing awareness of both the short- and long-term impact of concussions, the approach to sport-related concussions have evolved considerably over recent years. Some of the first known reports of brain injuries and associated symptoms come from Greek medicine and the writings of Hippocrates (460-370 BC). It was not until the tenth century when Rhazes, a physician from Persia, noted a distinction between a severe TBI and a concussion (Williams & Danan, 2016). The characterization of concussions continued to evolve and led to concussions being known as “shakings” or “commotion in the skull” resulting in a transient physiological state (Williams & Danan, 2016; McCrory & Berkovic, 2001). With the invention of the microscope in the 17th century came an attempt to understand the pathological distinctions that characterize a concussion, such as vascular anomalies and neuronal shock (Desault, 1830).

Furthermore, the definition of concussion has been unclear (McCrory et al., 2017), but the most accepted characteristics of concussions are immediate and transient alteration in the brain’s

function, level of consciousness, and mental status stemming from mechanical forces or trauma (Agarwal et al., 2021). However, understanding the full degree of damage caused by concussive injuries remains challenging. Nonetheless, as history and time have progressed, so too the understanding of concussions and the risk of sustaining a concussion in sport (Williams & Danan, 2016). While the transient state of permanent pathologic change remains under debate, sport remains an important part of society and health and strategies to minimize concussion risk and better ensure athlete safety, continued participation, and well-being are needed.

Concussions are a challenging problem faced by athletes and those who care for them, which for years was an unknown enemy to an athlete's career. In fact, concussions were often dismissed as a minor inconvenience until the relatively recent discovery of Chronic Traumatic Encephalopathy (CTE). CTE is a tauopathy (i.e., a neurogenerative disease) that leads to progressive deterioration of the brain and negatively affects the lives of many athletes including, but not limited to football players. While the National Football League chose to deny the existence and fight any claims of concussions leading to CTE, it was not until Dr. Bennet Omalu discovered CTE in a biopsy that the league acknowledged the undeniable evidence of the potential long-term effects of concussions (Boemer, 2013; Ilie et al., 2013). Younger athletes are similarly not without risk and complications arising from concussions. For example, Ilie and colleagues (2017) reported that adolescents with a history of a TBI are at risk of mental health, vocational, and relationship issues, substance abuse, as well as antisocial and conduct behaviors such as bullying and carrying a weapon on school property.

While concussions are commonly associated with high-impact contact sports such as football and ice hockey, as well as use of the head in sports such as soccer (Batten et al., 2016; McCrea et al., 2003; McCrory et al., 2013; Miele et al., 2018; Naunheim et al., 2000; Tommasone & Valovich McLeod, 2006), the relationship between non-contact sports and concussion risk and

occurrence is largely understudied. For example, despite its worldwide popularity, very little is known about the incidence, prevalence, treatment, and attitudes toward concussions in figure skating (King et al., 2017). With its repetitive, explosive movements and technical acrobatic routines, it has been well-established that figure skaters are prone to repetitive overuse stress fractures, strains, and sprains. However, it is clear that figure skaters are also susceptible to concussive injuries as a result of falling to the hard ice surface (Marchie & Cusimano, 2003; Marshall et al., 2015).

To date, much of the current concussive literature in figure skaters is based on personal accounts, lending to reporting biases and inconsistent reporting (i.e., unwillingness to acknowledge and or report a concussion) potentially lending to an inaccurate reflection of concussion incidence and prevalence in this cohort (Almond, 2017). Thus, while competitive figure skaters are a cohort that are at risk, much is left to be explored and understood on how concussive injury risk is perceived, reported, and mitigated in the sport. This study gathered information that will pilot and inform future studies, thus benefitting researchers, concussion sufferers, and the skating community as a whole.

2.1 What is a Concussion?

Previously, the definition of a concussion has been unclear (McCrory et. al., 2017). According to Agarwal et. al. (2021), a concussion can be any changes to the function of the brain, consciousness, as well as mental status of an individual due to mechanical forces or trauma. Concussions were once thought to be caused only by direct hits, or blows to the head; however, concussions are also known to be the result of a jolt to the head that causes a whip-like back-and-forth motion (CDC, 2020).

The primary concern with concussions is that they can result in permanent damage to the white matter of the brain (Henry et al., 2011). White matter is found in the deeper tissues of the

brain and contains nerve fibers (axons) covered by myelin sheaths (giving the brain a white appearance) that connect nerve cells (grey matter/unmyelinated neurons). The main function of white matter is to send signals to grey matter within the central nervous system (CNS) to function (Morell & Quarles, 1999). Damage and/or death of nerve cells results in impaired cognitive function and motor abilities, affecting an individual's mood (e.g., anxiety, mood swings, behavioral difficulties) and motor function (Henry et al., 2011; Ilie et al., 2016; Ilie et al., 2019).

2.1.2 Mechanisms of Concussion

The underlying mechanisms of concussion are relatively unclear. However, there are two main ways in which a concussion occurs; these are inertial and contact incidence (Meaney & Smith, 2011). Contact injuries (e.g., receiving a direct hit to the head) are more commonly recognized as a direct cause or risk of concussion (Meaney & Smith, 2011). While less understood, linear and rotational acceleration can generate shearing forces sufficient to cause or increase risk of concussion (Meaney & Smith, 2011; Ilie et al., 2017).

2.1.3 Signs and Symptoms of Concussions

A concussion's somatic symptoms can include fatigue, photophobia, phonophobia, vision impairment, vertigo/dizziness, tinnitus, light headedness, headache, and anosmia (Mullally, 2017). Cognitive and behavioral concerns, such as difficulty finding words, fogginess, concentration issues, mood disorders (e.g., anxiety, depression), personality changes, and irritability are also common. An important consideration and challenge in documenting and managing concussion risk and occurrence, however, is that some athletes who suffer concussions may appear asymptomatic (Harrison et al., 2018). Moreover, there are no imaging techniques currently available to definitively diagnose concussions. New diagnostic techniques to detect concussive injuries using biomarkers are being explored (McCrory et al., 2017), however these methods have not yet been

put into practice. Therefore, in the absence of any physical and/or mental signs and symptoms, there may be no clear indication that a concussion has occurred.

2.1.4 Chronic Concussion

Although there is no widely accepted definition of chronic concussion, it is best understood as a condition associated with multiple concussions occurring over time, long-term complications from concussions, and/or lingering post-concussion symptoms (Cantu, 2007; McCrory, Meeuwisse, et al., 2013b; Rabinowitz & Levin, 2014). A scoping review by McInnes et al. (2017) found that half of all concussion cases caused by a singular event resulted in long- term cognitive impairments, thus, creating a chronic concussive state. Chronic concussion can lead to impairment of cognitive function, including information processing speed and deficits in memory, attention, awareness, reasoning, communication, social behaviors, and executive functions (Rabinowitz & Levin, 2014). Rational decision-making is made more difficult by chronic concussions, resulting in reduced motivation due to apathy, impulsivity, and emotional irregularities (Rabinowitz & Levin, 2014). Notably, there is a cohort that will not ever fully recover, including those suffering multiple mild TBIs and those who fail to adhere to recommended concussion-related recovery protocols set out by physicians (i.e., premature return to sport) (King & Kirwilliam, 2011; McCrory, et al., 2013b; Ilie et al., 2018).

2.1.5 Chronic Traumatic Encephalopathy (CTE)

While concussions are of great concern due to the long-term implications such as memory loss, mood disruption, and overall quality of life created by TBI events, another growing concern is CTE. A systematic review by McCrory et. al. (2013a) suggested that chronic concussions in athletic populations would lead to CTE over time. CTE is a deterioration of the brain attributed to multiple head traumas (McKee, Cantu, Nowinski, Hedley-Whyte, et al., 2009b) and has been shown to be correlated with a history of high contact sport participation.

CTE was originally discovered in the brain pathology on necropsy of former athletes (Bieniek et al., 2015). CTE is a neurodegenerative disease that typically manifests decades after the end of exposure to repeated brain traumas and results in the rapid death and functional decline of neurons (Stern et al., 2011). While the symptoms of CTE mimic those of Alzheimer's Disease, including the rapid deterioration of the brain, behavioral and memory issues differ in many ways (McKee, Cantu, Nowinski, Hedley-Whyte, et al., 2009a). CTE involves the presence of tau-immunoreactive clusters in the superficial cortical layers of the brain (McKee, Cantu, Nowinski, et al., 2009a). A key trait that differentiates CTE from Alzheimer's Disease are the tau proteins that collect around small blood vessels in the superficial levels of the brain (Turner et al., 2016). Tau-immunoreactive proteins are commonly found in tauopathies, which are neurodegenerative diseases. These proteins then create clusters in the brain, which are then believed to break down neuropathways (Armstrong et al., 2017). These immunoreactive clusters are abnormal, and also tend toward the sulci and small blood vessels of the brain (McKee, et al.). This is important to note because CTE shares many symptoms with other factors created by concussions.

The symptoms of Post-Concussion Syndrome (PCS) may begin while CTE is developing, or PCS is resolving and CTE is emerging (Stern et al., 2011). Therefore, while PCS plays a part in CTE, PCS is not CTE; CTE's initial symptoms include memory problems, depression, emotional instability, having a "short fuse"/impulse control, executive dysfunction, and suicidal behavior. What exactly creates the right environment for CTE to manifest remains undetermined. It is known that multiple TBIs are necessary for CTE; however, not all who suffer multiple TBIs develop CTE (Stern et al., 2011). Interestingly, while the symptoms of PCS and CTE are very similar, the most notable difference is the suicidal behavior, which is not a noted symptom in PCS. Notwithstanding, PCS is known to trigger a depressive state and may put the athlete at risk of harmful behaviors (Stern et al., 2011).

The development of CTE and its risk factors, apart from multiple TBIs, are still relatively unknown. However, it appears that genetics may play a role in the development of the disease. Apolipoprotein E (APOE) is a genetic variable that has been linked to a heightened risk of CTE (McKee et al., 2010). This is an area of concern for those with the e4 carriers, as well as the individuals who are homozygous for the APOE e4 allele (McKee et al., 2010). The APOE e4 gene is responsible for creation of a protein that is apolipoprotein E and combines with fats (lipids) to form lipoproteins (Liu et al., 2013). APOE e4 is also thought to create inflammation in the brain (Liu et al., 2013). While genetics contribute to CTE risk, sport and position played within the sport also appear to play a role. Additional contributing factors are not yet well understood, and it is not known what type of head injuries lead to CTE. For example, boxers receive rotational blows to the head, whereas football players receive linear hits to the head (Viano et al., 2005). It was believed that boxers were the only cohort with debilitating symptoms, until football players were more recently discovered to have equal risk and issues stemming from repeated blows to the head (McKee et al., 2010).

2.2 Diagnosis and Management

The most common and recognizable symptom of a concussion is loss of consciousness (LOC), which tends to occur in higher-impact collisions and leads to brain tissue trauma (Miele et al., 2018). The challenge with concussion management is the prevalence of asymptomatic cases. The CDC's guidelines to spotting a concussion falls into two categories: Concussion Signs Observed and Concussion Symptoms Reported. Observed signs include an inability to remember events, appearing dazed/stunned, answering slowly, mood/behavior and personality changes, LOC, loss of coordination, and forgetting instruction/confusion of assignments (CDC.gov, 2020). Reported symptoms, on the other hand, consist of balance problems, blurry vision, dizziness, light

and noise intolerance, fogginess, memory problems, “not feeling right” or “feeling down,” nausea/vomiting, and headaches/pressure in head (CDC.gov, 2020).

Recognizing that some athletes who are concussed appear asymptomatic (Sicard et al., 2018), and as some underreport symptoms to return to their sport more quickly, other methods of diagnosing concussions are important to improve and ensure athlete safety. A study utilizing a Rest and Post-test structure to determine if medically cleared players would perform well on a cognitive function test showed that relative to their teammate controls in their respective sport, many concussed athletes were not ready to return to action, with 45% of the concussed athletes failing the test (Sicard et al., 2018).

In addition to the cognitive and personality risks, concussions have been noted as creating social isolation in younger athletes (Refakis et al., 2017). Possible causes of social isolation are likely to be due to the need for reduced hours at a and in sports in order to recover (Refakis et al., 2017). Furthermore, academic decline is positively correlated to TBI occurrence (Ilie et al., 2020). Similar to adults, concussions in youth are known to negatively impact cognition and personality, mostly in regards to learning speeds, mood, and behavior (Gillett, 2018). However, for younger children concussive symptoms take longer to resolve than in other age-groups (Refakis et al., 2017), which may lead to long-term life difficulties and the need for additional coping mechanisms (Ilie et al., 2014; Ilie et al., 2015).

2.3 Return to Sport

The amount of time it takes for an athlete to fully recover from a concussive event is influenced by many factors such as severity of injury, compliance with medical advice, failure to report/recognize, and history of concussions. The multitude of factors involved in an athletes’ recovery, often make it difficult to determine when an athlete should return to sport.

Traditionally, LOC is the most notable symptom that leads clinicians look for in diagnosing a concussion. Although LOC is a highly recognizable symptom of a concussion, it is not a predictor of long-term outcome and remains understudied in concussion research (Mullally, 2017). Therefore, looking for other key diagnostic symptoms is necessary.

A substantial concern with concussive injuries, is the nature of cumulative risk. That is, the more concussions an athlete suffers, the chance of a full recovery becomes substantially diminished (Hiploylee et al., 2017). Notwithstanding, the problem of early identification remains for asymptomatic concussed athletes. Interestingly, asymptomatic athletes were more likely to have slower reaction times and ability to complete a task than their symptomatic counterparts (Harrison et al., 2018). This is problematic as the time-delay to complete a task may be mislabeled or misdiagnosed. However, the delay of information processing was the defining difference between the two cohorts (Harrison et al., 2018). Understanding how to determine whether an athlete is ready to return to their sport is essential to an athletes' well-being, as many athletes return before having fully recovered (Hiploylee et al., 2017).

Compliance with healthcare providers during the recovery process is also a major factor in an athlete's return to sport. In a study by Hiploylee (2017), it was noted that only 27% of the non-compliant group recovered, while 67% of the compliant group recovered within a year. About 43.5% of athletes are estimated to return to their sport too soon, putting athletes at risk of recurrent concussive symptoms (Carson et al., 2014). Premature return to sport is likely due to numerous factors such as athlete motivation and perceived external pressure to return to sport (Burgess, 2011). Recent data suggests that pressure from fellow teammates, a sport culture of being "tough," and the risk of losing a roster position may coerce injured athletes to return to sport prematurely (Tjong et al., 2017)

2.4 Attitudes and Beliefs Regarding Concussion Risk in Competitive Figure Skaters

Despite a growing awareness of the significance of concussive injuries, there remains a lack of understanding of risks and prevention strategies lending to injury mismanagement and long-term consequences/complications (Ilie et al., 2014). Delays in seeking medical treatment can be attributed to social stigmas, lack of knowledge, attitude, and cost (Ilie et al., 2014). Interestingly, recent data has shown that figure skating presents a significant concussion risk comparable to that seen in contact and collision sports (Cusimano et al., 2017a; Nordström et al., 2020; Wang et al., 2015). The impact and/or whiplash motion caused by falls or hitting the athlete's head on the ice as well as the rapid spinning elements associated with the sport can put the athlete at risk of concussion (Wang et al., 2015). While many top figure skaters have reported suffering multiple concussions (Almond, 2017; Aleccia, 2014), there is a widely held belief among skaters that there is less risk of suffering a concussion than their contact sport counterparts because contact sports are what are more commonly associated with concussions (Wang et al., 2015).

While reporting biases and behaviors were similar between collegiate figure skaters and football players, there were more non-contact, sport-related concussions reported than those documented in contact sports (Weber et al., 2019). In other words, with the variables evened such as reporting biases, there were still more non-contact injuries than number of injuries in contact sports (Weber et al., 2019). This is a notable finding given that it is still a common misperception that contact sports pose a greater concussion risk (Kerr et al., 2016).

Unique to figure skaters is the concussion risk associated with repeated spinning movements. Intriguingly, spins require more energy than jumps, and create 200-300 lb of centrifugal force (Smith & Ludington, 1989). This means that there is a great amount of spinning force skaters place their bodies through by practicing and performing spins. This finding provides greater insight as to why concussive-like symptoms are observed in skaters with a high- spinning

training load (Wang et al., 2015). With the growing understanding of concussion risk in figure skating, appropriate precautions to minimize risk should be taken, as reporting biases and underlying beliefs regarding risk continue to place these athletes at risk (Cusimano et al., 2017). Numerous studies have reported the importance of educating both skaters and coaches as a means to reduce concussion risk (Ashwood, Athar, & Mirhadi, 2017a; Gretchen et al., 2018; King, DiCesaro, & Getzin, 2017a). CDC concussion guidelines state that a concussed athlete needs to be pulled from the sport and seek an experienced healthcare provider's approval for after-concussion care and return to sport (CDC.GOV, 2020). Despite mandated education protocols (Lavis, 2020), however, only 36% of figure skaters reported receiving concussion training (Gretchen et al., 2018). Whether or not education and safety protocols are followed more broadly is unknown (Gretchen et al., 2018; Kroshus et al., 2015; Cusimano et al., 2018).

While there appears to be a growing awareness among athletes, healthcare providers, and coaches regarding concussion risk in figure skaters (Almond, 2017; Aleccia, 2014), it is not well understood what, if any, mitigating strategies are being employed to decrease risk and how prevailing attitudes might impact overall risk. For example, Gretchen et al. (2018) found that 8% of athletes who reported hitting their head on the ice returned to their sport without medical clearance. Furthermore, there are currently no standardized definitions of at-risk falls, such as "hard-landings" that could better inform trainers and coaches on how to identify such concussion- causing incidents. The tendency to ignore bumps and falls, even head-related injuries, provides insight into possible underlying beliefs and behaviors that encourage brushing off injuries (Gretchen et al., 2018). The number of skaters who return to sport without medical clearance confirms that figure skating culture tends to ignore and "skate" past injuries, leaving numerous concussions unreported (King, DiCesaro, & Getzin, 2017a). Likewise, there may be behaviors and

beliefs that prevent this cohort from taking concussions seriously because of social pressure from other skaters (Almond, 2017).

The reasons why figure skaters do not wear protective gear such as helmets, regardless of continued education, documented risk, or even personal experience, is unclear. It has been suggested that vanity may be to blame. Even U.S. Olympian, Ashley Wagner, who has suffered multiple complications from concussions, is not yet convinced that she needs a helmet (Almond, 2017). Perhaps an attitude of imperviousness is catching up with figure skaters (Feder, 1994) and is leading to the downfall of the sport (Crane & Temple, 2015) It is commonly believed that experienced and higher-level skaters are taught how to fall "correctly," and that therefore only untrained skaters are at risk for concussions. A parent of an experienced child skater who had suffered a concussive event stated in an interview that "They get hurt when they're doing something simple," adding "When they're doing the big moves, they're taught how to fall" (Aleccia, 2014). These beliefs are contradicted by recent research that has shown that the higher-level skaters face the most risk for concussion (King, DiCesaro, & Getzin, 2017a). This discrepancy is attributed to opinion of coaches, parents, and skaters possibly clinging onto old, non-scientific beliefs (Aleccia, 2014), versus fact-driven data (King, DiCesaro, & Getzin, 2017a). The old adage about pride before a fall may be quite literally true here, as research has indicated that higher-level skaters are at the highest risk for concussions during practice (King, DiCesaro, & Getzin, 2017a). This data was captured via a 77-item survey called SKiPS (Skater Injury and Prevention Survey) and consisted of data such as: (1) skating demographics, (2) skating level and history, (3) practice habits, (4) off-ice routine, (5) non-skating competitive and recreational sport, and (6) injury history (King, DiCesaro, & Getzin, 2017a). These questionnaires were distributed at a 2011 United States Figure Skating (USFS) testing event as well as online recruitment platforms utilizing a link sent to the Professional Skating Association such as Facebook, email, and Skating

Club Pages (King, DiCesaro, & Getzin, 2017a). USFS noted, specifically for concussions, the groups experiencing most occurrence were the pairs skaters and ice dancers. The cause of this risk was specifically attributed to lifts (King, DiCesaro, & Getzin, 2017a). A similar study by Fortin (2003) also found that senior level pairs and ice dance skaters were more likely to experience injury, with the pair skating cohort having especially high rates of TBIs. This heightened concussion risk for pairs as well as the ice dancing cohort may be due to the lifts involved in their division (King, DiCesaro, & Getzin, 2017a).

However, the lifts are not the only cause of concussion. King. et. al. found that qualifying and nationally or internationally ranked skaters were more likely to experience concussions and face injuries. This is likely to be a result of higher speed and complexity of elements (King, DiCesaro, & Getzin, 2017a). For synchronized skaters, the risk of injuries are more likely to occur during practice and while working on team skills versus individual sessions (Gretchen et al., 2018). Interestingly, the risk of head injury was 9.59 times higher during practice than competition (Gretchen et al., 2018), likely caused by learning new elements. Practices also run the risk of collision with other skaters as well as ice-related problems (e.g., divots, unevenness, etc.).

The medical community has begun to notice the prevalence of concussions in figure skating. Dr. Rick Figler, sports medicine expert at the Cleveland Clinic, stated that figure skating TBIs are probably more common than anyone thinks (Aleccia, 2014). Among figure skaters, concussions appear to be the second-most prevalent injury at 7%, behind ankle sprains (11%) (King, DiCesaro, & Getzin, 2017a). Eleven percent of emergency room visits for ice skating- related injuries are TBIs (CDC, 2011). The extant literature notes that the number of concussions sustained by figure skaters may be higher than reported, even with reported numbers on the rise (King, DiCesaro, & Getzin, 2017a). While many skaters are able to recall injuries (Kjaer & Larsson, 1992), the memory loss caused by a concussion may skew the data. In an interview, Dr. Rick Figler made the point that

"if you ever go to a skating rink and watch kids practice, they fall and get up, they fall and get up … [but] they're falling on ice. It's a very hard surface" (Aleccia, 2014). Furthermore, the emphasis on "getting back up" in skating culture (US Figure Skating, 2020), belies the occurrence of concussions. Educating the skating community in reducing concussion risk while still enjoying the sport is important not only for skaters, but also to find ways to preserve the sport as a whole. The findings that even highly experienced skaters have high rates of concussions (King, DiCesaro, & Getzin, 2017a) negates the belief that there is a "safe" way to fall. Perhaps there is no proper way to fall if the skater is taken by surprise, causing their head to move back and forth rapidly; no matter where the skater lands a jolting motion of the head and neck poses a huge risk for concussions.

The scientific and medical communities all express a common belief- helmets protect skaters. For skaters, helmets, more specifically hockey helmets, reduce severity of injury and facial injuries (Ashwood, Athar, & Mirhadi, 2017a). In fact, numerous studies agree that helmets are necessary to protect skaters (Cusimano & Kwok, 2010a; Cusimano & Kwok, 2010b; King, DiCesaro, & Getzin, 2017b; McCrory et al., 2013). In a study with different skating domains, ice and roller, figure skaters were known to have more concussions at 4.3%, and a rate of 13.3% for overall head injuries (Knox, Comstock, McGeehan, & Smith, 2006a). This statistic is in comparison to inline skaters who have a rate of 0.6% concussion and 4.4% overall head injury. Although the risk of concussion and post concussive complications would be reduced by use of helmets (King, DiCesaro, & Getzin, 2017a), many skaters push back on helmet use by claiming that there is lack of scientific evidence. According to US Olympic skater Rachel Flatt, "The anecdotes aren't enough to scare them into doing something proactively… There hasn't been enough research" (Almond, 2017). Claims of a lack of evidence of concussion risk in figure skaters is not unfounded as the bulk of the concussion literature focuses on male-dominated sports such as

American football. However, current evidence suggests that figure skaters, while largely overlooked, are a higher risk group (King, DiCesaro, & Getzin, 2017a; Knox, Comstock, McGeehan, & Smith, 2006a).

Currently, the most viable option for the management of concussions in figure skating is prevention through the use of protective equipment (e.g., helmets) and reducing the frequency of spin training (Batten et al., 2016). However, the reluctance to use helmets is likely to be an indicator in possible attitudes toward spin training reduction. Many studies report that educating skaters and coaches would aid in use of protective equipment (Ashwood, Athar, & Mirhadi, 2017a; Schieber et al., 1996). When this behavior was studied in what is considered to be a similar cohort only 7% of in-line skaters used all equipment, while 46% wore none (Schieber et al., 1996), therefore, there may be underlying cultural norms when it comes to concussions. For the figure skating cohort, the primary difference is when breaking a fall with arms, there is little grip between the arms and hands with the ice (Knox, Comstock, McGeehan, & Smith, 2006b), thus creating more possibility for concussions. Moreover, the use of helmets has received substantial resistance and only 0.06% (3/520) considered use of helmets during practice sessions (Gretchen et al., 2018). The three individuals chose to wear protective equipment (n=3): 67% due to prevention and 33% based on coach's recommendation (Gretchen et al., 2018). The exact equipment varied between two wearing Ice Halos and one wearing a helmet, furthermore, the protective gear was only used in practice setting (Gretchen et al., 2018). The lack of protective equipment utilization is often attributed to the aesthetic aspect of the sport, in other words, helmets aren't aesthetically pleasing. However, the use of equipment such as helmets may have successful implementation in the team setting (Gretchen et al., 2018). Additionally, premature return to play is known to be a major predictor in concussion recovery and outcome (Hiploylee et al., 2017), a better understanding of

underlying attitudes, beliefs, and motivations of athletes who against doctor's orders return to sport is also needed.

2.5 Qualitative Descriptive Approach using Thematic Analysis

This study sought to explore competitive figure skaters' experiences with concussion. Given the lack of research in this area, a qualitative lens was chosen to gain a deeper understanding of participants lived experiences and how these experiences have shaped athlete knowledge, attitudes, and beliefs towards concussion risk, prevention and management. Qualitative description seeks to translate human experiential events into comprehensive everyday terms (Sandelowski, 2000). Qualitative descriptive research is appropriate for research with the aim of learning more about a poorly understood phenomenon and where no pre-existing theories are relied upon (Sandelowski, 2000; Kim et al., 2017). While descriptive qualitative analysis is not interpretive, there is an element of interpretation that takes place (Sandelowski, 2000). Furthermore, qualitative descriptive design is relevant where information is required directly from those experiencing the phenomenon under investigation in its natural state (Bradshaw et al., 2017; Kim et al., 2017). In the case of this study, those experiencing the phenomenon of interest (i.e., concussions) are figure skaters who are the experts in giving meaning to their own experiences. Ontologically, qualitative descriptive analysis allows for the belief that multiple realities exist and that there is no singular truth (Bradshaw et al., 2017). Further, it facilitates knowledge generation versus data classification allowing the researcher to create meaning and present concrete findings (Sandelowski, 2000).

Thematic analysis is a method for identifying and reporting themes in data (Braun & Clarke, 2006). Thematic analysis is a commonly used analytic approach in qualitative descriptive research (Vaismoradi et al., 2013) and is frequently employed in the realm of sport and exercise psychology (Braun & Clarke, 2006; Braun et al., 2016). It is theoretically flexible, meaning it allows the researcher to determine themes in a number of ways and is benefitted by multiple and diverse

participants (Braun & Clarke, 2006). A theme is more than a patterned meaning, in fact a theme has to bring light to something important about the data that is also relevant to the research question (Braun et al., 2016).

Thematic analysis is beneficial in the way that there is not a particular framework that binds the data. There is flexibility across the spectrum of ontological and epistemological positions (Braun et al., 2016). As noted by Braun et al. (2016), thematic analysis is an active process, therefore; is seen as a method rather than a framework.

This study took an inductive approach meaning the data drove the analysis (Braun et al., 2016) in the form of asking "What are the experiences, knowledge, attitudes, and beliefs of current and former figure skaters relating to concussions?" with no frameworks binding the data and questions. Inductive analysis is ideal for cases in which there are no previous studies focusing on a phenomenon (Vaismoradi et al., 2013). Additionally, an inductive approach requires little interpretation, thus reducing bias and allowing the data to speak (Sandelowski, 2000). This is not to minimize interpretation, rather, this methodology allows for exploration. This is in contrast to a deductive approach which seeks to compare categories in different periods of time or to test a theory (Sandelowski, 2000).

Themes are created by generating codes, and to create codes, there is a six-step process to follow. According to Braun & Clarke (2006), there are six steps to thematic coding: creating familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining/naming themes, and producing the report. The researcher followed these six steps in order to create a thematic analytical approach.

2.6 Conclusion

The risk of concussion is likely never going to be completely removed from sport participation, however given the numerous benefits of sport, strategies to mitigate risk are needed.

Through seeking and describing the lived experiences, knowledge, attitudes, and beliefs of competitive figure skaters relating to concussion risk, prevention, and management this study provides important insight on strategies to mitigate injury risk in figure skaters.

CHAPTER THREE: METHODS

3.1 Research Design

Employing an inductive, thematic analysis approach, the experiences, knowledge, beliefs, and attitudes of competitive figure skaters with respect to concussion risk, prevention, and management was explored. A research interview guide and probing questions was created in consultation with the lead researcher's (CF) committee members, experts in qualitative and concussion research. This guide was shared with one competitive figure skater to assess language, wording, and relevance. A formal pilot study was not conducted.

3.2.1 Researchers Description

The lead researcher has been part of the figure skating cohort off and on since the age of four, providing her with a shared lived experience and ability to connect with participants. Her background is in sport management and sport psychology. She has been an athlete and coach (ice-hockey and has been involved in aspects of sport management. Her beliefs are maintaining and growing sport while ensuring all stakeholders have an optimal sport experience. While useful, this background also introduces the possibility for bias. The researcher herself has experienced concussions both due to figure skating as well as walking on the sidewalk and tripping, therefore notes that concussions can happen anytime and anywhere. Concussions can happen wholly on their own, but also can happen in figure skating, which the researcher use to not believe until 2019. To mitigate her own biases, she has noted a set of assumptions and beliefs that may bias the study findings as presented. These assumptions are whiplash falls should be checked by a doctor as much as hitting one's head on the ice. Furthermore, the researcher believes that repetitive high velocity spins are potentially hazardous (Wang, 2015), yet still need further investigation because spins are essential to the figure skating sport. Noting that is bias is based on a single study with no follow-ups to date. Pairs are also particularly dangerous with a different set of hazards introduced with

throws (King, 2017). Apart from these, figure skating is no more dangerous than other winter sports and is better than no exercise at all. However, she does believe that helmets should be required for beginner skaters, but protective fashion for training may be the key to cohort participation. These beliefs are made transparent to reduce the risk of bias. Furthermore, weekly meetings with her supervisor helped to check bias. The use of first-hand participants' accounts allows for the study to see the experience through the eyes of those that have lived through the events in figure skating. Ultimately in thematic analysis, the data is the driver (Braun et al. 2016).

3.2.2 Participants

Eligible participants included both current and retired competitive figure skaters (many of whom are now or were previously also coaches). Specifically, competitive adult (18+ years) figure skaters and/or former figure skaters living in either the United States or Canada, and were English speaking were eligible to participate. For the purposes of this study, "competitive" was defined as any figure skater/former figure skater who have trained for a minimum of 12-months and have competed in any formally judged competition/test. Male and female, single and pairs figure skaters were eligible to participate. There was a need for both singles and former pairs skaters as there are unique elements to single and pairs skating. Non-English-speaking participants and individuals under the age of 18 years were excluded from participation. Participants need not have knowingly incurred a concussion to be considered for study participation. Participants interested in learning more about the study were directed to contact the lead investigator by email. After the researcher answered any pending questions, participants received a copy of the informed consent for review. All 19 participants received a $10 Starbucks gift card in appreciation of their time.

After sending over 1,000 recruitment inquiries, 19 current or former figure skaters consented to complete the interview (participant characteristics are presented in Table 1). An additional three potential candidates expressed an initial interest in participation, but additional

attempts to contact them were unsuccessful. In brief, 18 females and 1 male (mean age 24 ± 6.1 years), with an average career length of 23.68 years of competitive skating experience participated. Seven participants reported a history of a concussion, six reported a suspected concussion and six participants reported never having suffered a concussion. Note, a handful of participants that said they've never had a concussion as well as those who did not experience a concussion had experiences that without doctor's diagnosis there cannot be confirmation of concussion. Additionally, it was not explicitly asked if skaters were from a specific domain of skating (such as pairs/synchro) to prevent easy identification because often most rinks only have one pairs team per rink. This is due to the fact pairs teams take up space on the ice.

Table 1

Participant Characteristics

Participant Number	Sex	Age (years)	Highest Level Competed	Competitive Skating Experience in Years (total years skating)	Age First Exposed to Sport (years)	Still Skating Competitively?
1	F	18	Bronze	2-3	15-16	Yes
2	F	26	International	14-15 (22)	4	Yes
3	F	25	International	18 (19)	6	Yes
4	F	25	National	6 (19)	6	No
5	F	20	National	4 (16)	4	Yes
6	M	28	Regional	3 (15)	13	Yes
7	F	19	National	(16)	3	Yes
8	F	18	Juvenile	8 (9)	7	Yes
9	F	19	Novice	16	3	Yes
10	F	35	National	20 (12)	14	Yes
11	F	22	International	10	12	Yes
12	F	32	International	27	5	No
13	F	38	Regional	20	6	No *Skates with Family
14	F	19	National	12	3	Yes *Noted Collegiate
15	F	22	National	11	8-9	Yes
16	F	20	|National	12-13	8	Yes
17	F	19	National	13	6	Yes
18	F	Not captured by recording	Regional	3-4	6-7	Yes

Participant Number	Sex	Age (years)	Highest Level Competed	Competitive Skating Experience in Years (total years skating)	Age First Exposed to Sport (years)	Still Skating Competitively?
		*Verified Participant was 18+				
19	F	27	National	16	8	No *Skates for Leisure

Note: Included participants from both Canada and the United States.

3.2.3 Participant Recruitment and Selection

Following ethical approval from the Dalhousie University Health Sciences Research Ethics Board (REB #2021-5588; Appendix F), participants were recruited through social media (e.g., Facebook, Instagram, Twitter) and snowball sampling (i.e., word of mouth) (Allen, 2017) from September 8 to December 1, 2021. Study information was also shared with local, regional, and national skating clubs (e.g., Skate Canada, US Figure Skating) to share within their members on their respective public social media sites (see Appendices B and D). After initial participant inquiry, eligible individuals were sent an information sheet with the consent statement for review. The consent was reviewed again prior to beginning the interview to confirm participant understanding of the purpose of the research and risks/benefits of participation. An incentive of a $10 Starbucks card was advertised and given upon finishing interview regardless of completion. Participant recruitment continued until data saturation and no new themes emerged.

The bulk of participants were recruited from figure skating clubs from both the United States and Canada (see Appendix B). This was done by primarily email, but also by Facebook for clubs that had expired email sites/no email. Additional participants were recruited through Instagram and Facebook ads with United States and Canadian handles/profiles. The exact clubs and locations of participants were not tracked to maintain privacy. Recruitment efforts continued until data saturation and no new themes/information was generated (Guest et al., 2020).

3.3 Data Collection

Following informed consent, each participant took part in a one-time semi-structured interview. Interviews were conducted via web-based conferencing software Zoom (one telephone interview was conducted when Zoom was not working). A mutually agreeable time was coordinated to complete the interview. Interviews lasted between 10-40 minutes and

included both closed and open-ended questions to: 1) collect demographic information (age, sex, years of experience, level of competition, single/pairs skater, current/retired skater); 2) gain insight into participant beliefs and attitudes around concussion risk and injury prevention in figure skaters; and 3) assess figure skater's awareness of concussions. Probes based on individual responses helped to increase the level of detail and resulting data, thus providing a more comprehensive description of participant experiences, attitudes, and beliefs. Participants were given the option to confirm that their transcript accurately reflected their beliefs and attitudes prior to final analysis (i.e., member checking; Ryan, Coughlan, & Cronin, 2007). Member checking was completed via email by sending transcripts back to participants. Only two participants (4 and 19), sent in an edited transcript while the rest of the participants were satisfied with the transcripts. Participant 4 edited answers and Participant 19's data was somehow not fully captured by the recording device, so the participant was able to fill in missing data. Participants were given two-weeks to provide and return feedback. Data saturation was reached with 19 participants (Vasileiou et al., 2018; Malterud, 2001; Tjong et al., 2017).

3.4 Data Analysis

Data collection and analyses were conducted simultaneously following Braun & Clarke's (2006) six steps to thematic coding (i.e., creating familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining/naming themes, and producing the report). Step 1 involved reading and re-reading the transcripts to become familiar with the content (Appendix H). Step 2 entailed generating and grouping initial codes. Step 3 involved searching for and identifying preliminary themes within each transcript; allowing the researcher to remove a theme that wasn't heavily relevant. Interview data was also analyzed using NVivo 12 (QSR International) to aid in coding and organizing developing themes. Preliminary themes

where then reviewed and agreed upon with the primary supervisor and the final themes were generated in step 4. Themes were then defined/named in step 5. After reviewing the themes and coming to an agreement (Coughlan et al., 2007), step 5 involved the write-up of the final report.

3.5 Methodological Integrity

Data analyses began following the first interview and helped to guide future interviews and analyses. The lead researcher conducted all the interviews, transcribed the data, and kept a reflective diary (Bailey, 2008). The researcher analyzed the transcribed the data recorded in the first-person participant perspective, from a third person view. Resultant themes were shared and discussed with the primary supervisor. Hand-written thematic coding was performed as well as an NVivo 12.0 coding in order to confirm themes.

The qualitative methodology allows for different lenses to be applied. Consistent with inductive qualitative work, no hypothesis was created as this would skew the data; rather the research question guided the data to be obtained via interviews. Ultimately, the data speaks for itself. However, the viewpoints of the lens of the author were taken into consideration.

When analyzing and receiving the data, the interviewer centered what will prolong the experience of figure skating, while keeping experiences positive and prevent injury, at the forefront of the research. This lens is prominent in the research. This is both intentional and unintentional as the skaters' well-being and feasibility of improvements were considered. The researcher's knowledge, empathy, and understanding adds to the data. Figure skating is a world of its own and this is a consideration.

There were many checks used along the way to validate the findings of this qualitative study. First, the researcher had to bracket her own assumptions and let the experiences speak for themselves. Participants were also given transcripts to validate the written accounts. Next, using

Yardley's (2000) criteria, the researcher had sensitivity to context, commitment and rigor, transparency and context, along with impact and importance. Finally, the study findings were also guided by critical friends. In this case the student's final analyses were reviewed and critiqued by her examination committee (Smith & McGannon, 2018).

In order to meet Yardley's (2000) sensitivity to context as a component of trustworthiness. Not only was a literature review performed beforehand, but the researcher herself has been part of the cohort since the age of four. Along the way, the researcher has known many individuals who have experienced a concussion as well as having experienced a concussion herself.

The researcher followed Yardley's (2000) recommended commitment to the research noted as "prolonged engagement with the topic". By being in the cohort for 20+ years with multiple concussion experiences in and out of the sport, the commitment assumption is verified. Rigor is established through the in-depth interviewing process. The organization, presentation, and analysis of the data was not only of importance to the researcher, but also to those around her. The participants matter the most, and the intent of this study is to enrich the lives of figure skaters.

Finally, as a component of trustworthiness, Yardley (2000) notes that methods must be articulated and that the information and knowledge must be useful, engaging, and important. This study is meant to shed light on a subject in a niche population. Specifically, this research is meant to help skaters, parents, and coaches alike to create the safest skating environment possible.

CHAPTER FOUR: RESULTS

Using inductive, thematic analytic approach, three superordinate and nine subordinate themes emerged from the analysis of participant experiences: 1) Complications due to concussions with subordinate themes of "acute consequences" and "long-term/chronic consequences," 2) Skating Safety Education and Awareness with subordinate themes of "understanding risks," "need for greater education and awareness" and "coaching certification, and 3) Risk reduction with subordinate themes of "falling and core strength," "not much can be done," "protective equipment," and "technique". The superordinate and subordinate themes are shown in Table 2.

Table 2

Experiences of Current and Former Figure Skaters Relating to Concussions

Superordinate theme	Subordinate theme
Concussion Consequences	Acute consequences (e.g., headaches, dizziness, loss of coordinate, sleep disturbances)
	Long-term/chronic consequences (e.g., coordination, mental health issues)
Skating Safety Education and Awareness	Understanding risk
	Need for greater awareness and education
	Coaching certification
Risk Reduction	Falling and core strength
	Not much can be done (hazards of the sport)
	Protective equipment
	Technique

4.1 Superordinate Theme 1: Concussion Consequences

Two subordinate themes emerged that represent participant experiences and understanding of concussion consequences; these were acute and chronic/long-term consequences. All participants, regardless of concussion history were able to report an array of acute and long-term consequences associated with a concussive injury.

4.1.1 Acute Consequences

Skaters had both firsthand as well as vicarious experiences of concussion symptoms. Participant 10 described concussions based on what those around her had mentioned when it came to acute concussion consequences. "I feel like I've heard people say, like, you could have, like, vomiting after and like your head would hurt." Participant 12 noted that some are asymptomatic when it comes to experiencing a concussion, expressing that "They could have dizziness, they could have nausea, sleep problems, problems with concentration or memory. Or sometimes nothing at all." Participant 15, similarly noted an array of symptoms, but mentioned that there is still much to be learned about concussions.

> After suffering a concussion? They vary, they're still under research, but either immediately or after the time of the injury, they start suffering anywhere from just very strong headaches, or can be even mild headaches over a period of time. Like long term mild headaches, or migraines, but also loss of coordination, excessive sleep or lack thereof. And then if it's severe, it can cause, vertigo, nausea, vomiting, for no reason related to their stomach because of the injury itself.

Having suffered a concussion, Participant 7 identified several symptoms associated with her concussive experience.

> Anything from dizziness, headache, nausea, hearing loss, some loss of eyesight, lack of...foggy headache and unclear thought sleepiness, or even sometimes they are not able to go to sleep.

> …I have had a concussion before. I experienced most of the normal symptoms. I was doing a jump, and I fell backwards and I hit the back of my head… and I lost my sight and hearing for a little bit, I don't remember exactly all the details about it. A day later, I went to the doctor and they diagnosed me.

Similarly, Participant 19 having experienced a concussion and visiting the emergency room, learned of several potential consequences of a concussive injury, including. The symptoms she listed as being that of a concussion are the following: “Pain at collision site, sensitivity to light, short term memory loss, vomiting, amnesia, loss of balance, brain bleeding, hematoma, etc.”

4.1.2 Chronic/Long-Term Concussions

Many skaters described an awareness of several long-term effects of concussions. Participant 11 expressed concern for a friend who had suffered several concussions and the long-term consequences associated with the injury.

> I've had a friend who was concussed several times over her career and ended up having to quit skating. And I know far fewer people who have gotten like other mechanical giant injuries, or like I don’t know broken bones. Pulled you know, muscles or like torn ligaments, stuff like that who have had to like truly end their skating career. Um, there’s a girl I know who has had permanent learning disability issues from her concussion. Um, and it was like, had to work incredibly hard to achieve what she has and I think I just haven't really heard those long-lasting impacts from other types of injuries. And I know it's not I should not be downplaying any other types of injuries, but I think the long-term effects are a little bit different. Um, you know, if you break your leg or something you might have to stop skating. But, you probably train yourself pretty easily to be able to do other things as long as it's not like a continued injury risk for that type of injury. But I think it's, it can be more pervasive and overarching to

have a brain injury than any other type of injury. Just because there's so many unknowns as well as to what-what the long-term effects will be for you particularly.

Participant 18 understood long-term effects including memory loss and susceptibility to subsequent concussions explaining that, "Like memory loss or a higher susceptibility to like other future concussions." Participant 14 expressed that concussions "…can lead to probably some mental health issues, as well as, just like lack of coordination, and probably the possibility for more serious injuries along the line." Although no participant specifically identified PCS or CTE as potential long-term consequences of a concussion, Participant 15 did describe the potential severity of concussions including brain damage and more severe outcomes, "The long-term definitely loss of coordination, loss of memory, and I think it can be a cause of death if untreated. So, maybe it happens today, but over 30 years without the proper treatment. That can be the main cause of death."

4.2 Superordinate Theme 2: Skating Safety Education and Awareness

The need for additional education and awareness was conveyed through two subordinate themes, "need for greater awareness and education" and "coaching certification".

4.2.1 Understanding Risk

On the whole participants expressed an awareness of concussion risk, with some rating the risk as moderate-to-high. Participant 15 shared that, "The consequences of the impacts that can happen on the ice and the probability of the amount of training, the risk is high for figure skating sports." Similarly, Participant 13 expressed that, "I think the risk is obviously higher than most, mostly because ice is slippery and blades are small." Participant 5 stated that,

> So, there is quite a large risk, especially when you get a I suppose there's a risk at any age, but especially when you get into doing your doubles and triples your, you're skating faster, and you're jumping higher. Your risk of landing hard or wrong increases dramatically. So, there's

definitely a very high risk there, if you take a wrong edge and just wipe yourself out. It can definitely mean a big difference.

While others described a low-to-moderate level of risk compared to other sports with greater contact to the head.

> I think they're relatively low in comparison to like large contact sports, like football, where they're pummeling on each other. But I think it's higher than people actually expect because we fall fairly frequently. (Participant 18)
>
> I don't believe that it's a huge risk just through my own experience. I feel like a lot of the falls we take are not directly towards the head, but it is a possibility. I have seen it happen before in pairs, I believe. But, it is a risk and it should be accounted for, but I do believe that most of the time most of our falls are not in that brain area. (Participant 17)

4.2.2 Need for Greater Awareness and Education

Figure skaters have contrasting views when it comes to concussions and education in the realm of figure skating. Participant 15 noted the need for additional education and awareness regarding concussions and figure skating:

> So, let me start by saying that I think they're much better managed now. I don't know, I haven't been in the sport that long, but I know the history of it. And also, this history about concussions, per se, you know, in other sports we didn't know…You should be exposed to just to the right of knowing what the worst consequences could be. So, like when we're teenagers and we're showing like this car crashes, and like, I don't know if that's the right thing, but we know that if something happens, you can find our parents. And similarly, like these things regarding concussions if like maybe you're doing this practices, they can lead to concussions. The other thing is about training, about response to identify these cases of when a concussion happens. So, it's not just on…[Somebody] maybe fell and they're feeling ok. But I think the

> training not only of myself to be aware of when I can suffer concussion and what their consequences would be, but it can assist others, even if I'm not coach, if I'm not rink manager, or owner, or a trainer in other sports. I think it is it is important, to have, like life, like lifesavers for divers, that's expected because they're in the water all the time. They're expected to know themselves, and how to rescue another fellow sports person. Similarly, I think that's lucky because a lot of time people don't know what to do with other injuries and they need to find a coach, or to find somebody at the pro shop. And I think that's more, I think that should be…I think there should be better at all levels, because even in kids at certain ages should be able to at least know how to react to certain things. Because if nobody else is watching, and that's where in the sports person think that they're ok, then that's when the long-term effects of a concussion can happen.

In contrast Participant 17 suggests that as the risk is relativity low in figure skating there hasn't been much of a need for concussion awareness. "I don't think that figure skaters on their own have received much information about concussions because I don't think it's been a huge issue in the past."

Additionally, many skaters did not express an awareness that concussions can be caused by falling and hitting their head on the ice. Participant 10 "I've like hit my head twice while skating, and it's like once it's happening, you can't really stop it. So, I guess it's kind of a risk. But I mean, I also don't do anything to prevent it like wearing a helmet, so…yeah…". Later expressing "I have never thought that I've had a concussion". Similarly, Participant 2 described an experience where following a fall and her head hitting the ice, she continued practice for 5 days. She did not know she had a suffered a concussion until she went to the emergency room for an ankle injury, and the doctors noticing her slurred speech led to the concussion diagnosis. She was shocked and never assumed she had a concussion because figure skaters did not experience those. Participant 2 also shared that talking about concussions was considered "taboo" and until more recently, it was extremely frowned upon to

talk about any possibility that concussions could be tied to the sport. Participant 2 suggested that the attention concussions have received since the NFL and NHL have recognized their respective sports risk has increased awareness across other athletes, including figure skaters.

> … when I used to think about concussions five or six years ago, I would think like NFL players playing football and getting tackled and smashed into the field or something like that, or a hockey player smashing into the boards and sliding or getting into a fight and getting hit in the head or something. I didn't think figure skater taking a big fall would be anything that led to a concussion. (Participant 2)

Overall, there was a mix of experiences among participants, ranging from skating does enough to figure skating needs to do more to keep up with sports such as the NFL and NHL. Participants described education materials as being present, but hard to come by unless knowledgeable. The ones that exist are not engaging and "create more work", and often are not figure skating specific (Participant 15). Participant 7 explained,

> I have not received any education regarding concussions. I think if I would have, I would have liked to have been more informed on what exactly it is and (um) how to recover in the best way possible. Really specifically for figure skaters.

4.2.3 Coaching Certification

Participants also expressed that coaches play a key role in how seriously they took concussions with responses such as "Oh, you just bumped your head, you'll be fine." (Participant 5). Participant 18 similarly noted, "One of my coaches was very like… didn't really seem receptive to extreme injuries." An account from Participant 14 detailed the expectation to return to the ice, sharing that "I remember watching like one of their skaters got a concussion, and the coaches not understanding how severe that was and like trying to get them back on the ice as soon as possible."

Other skaters similarly noted the role that coaches play:

> I think the coaches play a big role as well, because it's easy for us to say as a coach like, 'Oh, like… just they just kind of bumped their head and, you know, just kind of let it keep going. Let them keep skating.' But if we could if we do that, we really could be causing them more damage. (Participant 12)

Skaters noted that coaches play a key role in supporting athletes both on and off the ice. Participant 12, a competitive skater, now coach states "And especially if the parents don't understand concussions very well either, we really have to advocate for the skater.". Others commented that "everyone is involved" (Participants 15 and 19).

Participant 4 shared her experiences as a coach and receiving certification.

> I coached skating. We had concussion requirements to take. You must take a certification to be able recognize a concussion. In addition, I have family members and friends that are in the medical field. Concussions are something that I have been aware of and educated on. I have had several students experience concussions and had long term effects from concussions. I am always interested in learning more about concussions. However, I don't have a medical degree, so I was never one there I could actually diagnosing a concussion. I would always refer them to a medical professional. However, I'm always learning on how I can better educate myself.

4.3 Superordinate Theme 3: Risk Reduction

Whether participants viewed concussion risk as either high or low, there was an awareness that there are ways to reduce risk.

> I think any time that you're working with a sport requiring increased physical effort, there's always a risk of concussion. You can walk on the sidewalk, and you have a risk of concussion. I would say that figure skaters definitely are at risk for getting concussions, but there's some things that you can do to reduce that risk a little. (Participant 4)

> But, you know, there are proper techniques that can be used to… lessen the risk of falling and hitting your head. Generally, off-ice training before you put things on the ice, or harness work, are always helpful in training your body to be where they're supposed to be when you do try to do them on the ice. (Participant 13)

The need for risk reduction was conveyed through five subordinate themes, "falling backward and core strength," "nothing much can be done," "protective equipment," "referral and medical oversight."

4.3.1 Falling Backward Core Strength

Falling backward tended to be how the skaters who experienced a concussion had sustained the injury. Participant 7 stated that, "I fell backwards" and Participant 1 shared her experience of falling backward coming out of a spiral, "One time I was in a spiral and I was down in the spiral, and as I came up, I just kept going back and I just fell back on the back of my head". To reduce the risk of uncontrolled backward falls, some skaters noted that core strength may help. Participant 12 stated, "And core strength, so that way when you do fall, you know, hopefully you can keep your head from hitting the ice and that type of stuff." Similarly, Participant 4 echoed the importance of core strength.

> I would say there's a part of figure skating that is about skill and prevention for concussions. I work with a lot of my kids as well as in my own skating. I teach how to fall and the importance of core strength. I think core strength incredibly important. If you are not having a strong core, when falling and your body is going to go places that you don't want it to. It's extremely important to work on core strength, work on body awareness, talk about how you feel, what to do when you fall, and practice falling. If a skater just doesn't know how to fall. I've had kids that I work with that you literally teach them how to fall. You bring to their awareness that could happen, work on their core strength, work on their general body athleticism. Obviously, there's things that are out of your control and you can't always prevent

it – accidents happen. Core strength, body awareness can help prepare you for those unfortunate situations, but there are things that you can't control.

4.3.2 Not Much Can Be Done (Hazards of the sport)

Many skaters noted “not much can be done” (Participant 19) as well as “accidents happen” (Participant 4). Skaters mentioned that other skaters on the ice pose an additional hazard with Participant 12 describing, “just even two skaters skating, and they don't see each other and they- they run into each other. Like that could happen at any time as well.” Participant 14 noted that the risk of suffering a concussion is increased on crowded ice surfaces, stating:

> I skate at a bunch of different ice rinks, and I know that there's like some rinks that where the freestyle sessions, like our practice sessions are super crowded. And that, I think definitely has a much bigger impact- like risk for a concussion just with the risk of colliding with another skater. It's happened to some of my teammates before.

Participant 11 described just how unpredictable figure skating can be for participants. When describing collisions, the participant stressed how serious these events are and possibly they are one of the largest hazards of the sport. Collisions are very much a possibility in figure skating:

> Honestly, I think really anything it's a really unpredictable- like the way that the way that you fall is like very unpredictable. And I think that a lot of times you might not…you might not really have control over that and anything can kind of result in any type of injury, including a concussion. I think also collisions in synchro especially are, um, kind of a problem, just because everyone is so close. Um, and then I guess in freestyle it’d be mostly jumping. Spinning- you've got maybe a little bit more control over your body and you're a little bit closer to the ground. (Participant 11)

Skaters stressed that some aspects of the sport are hazardous with little solution. Interestingly, many skaters describe figure skating as what is known to be a non-contact sport, yet others who have witnessed collisions note there are in fact many points of contact/collision.

4.3.3 Protective Equipment

While protective equipment, including a helmet or a halo have been suggested to reduce concussion risk, Participant 16 noted “we're not really allowed to wear any kind of protective gear”. While Participant 18 said “I’ve never used it myself.” These participants didn’t give reason as to why they wouldn’t or weren’t allowed to wear protective equipment, which could be anything from the mental aspect where the equipment becomes a sense of security, or this could be from an artistic/aesthetic aspect suggesting that the design of protective equipment may need to be reconsidered. Participant 6 described the use of protective equipment as being challenging, because “It's a very difficult thing because no one really wants to wear something big and bulky while figure skating.”

The overall tone of protective equipment was that it existed and is encouraged for the overall safety of younger athletes, “with little kids in group lessons we do advise them to wear helmets, but I've only seen one type of equipment that someone developed for older figure skaters like a headband that they wear” (Participant 16).

4.3.4 Technique

Technique for figure skating and coaching, according to skaters, has room for improvement. Skaters had many opinions when it came to teaching new techniques. For example, suggesting the need for additional technical training and the ability to breakdown an element into safer learning components. Participant 7 noted that sometimes the sport is just taught by going for it, not taking time to learn and break down elements:

> I think, to perform a technique in a way that is the safest for the skater rather than learning. Learning something for example jump and getting it done, rather than it being the safest way possible. (Participant 7)

Skaters also mentioned the risk in the change from single jumps to double jumps that those learning the sport may not be aware of:

> Aspects of the sports definitely jumps, I wouldn't say single jumps, but definitely that transition from singles to doubles jumps. I think that is it increased… they're increased risk. Another one that is less concrete would be just any point when the skaters are transitioning levels of like a maneuver that they didn't used to do. (Participant 15)

The participant's descriptions did not include what has worked to make these transitions safer or easier, however, there was a shared experience with the need to improve teaching technique and safely transitioning to more difficult skills.

CHAPTER FIVE: DISCUSSION

The purpose of this study was to examine how figure skaters' experiences with concussions shaped their beliefs and attitudes towards concussion risk, prevention, and injury management within the sport of figure skating. Three main themes emerged from the analysis bringing to light that figure skaters understand the consequences of concussions, need for additional education and awareness, and understanding and need for risk reduction strategies. This section will discuss this study in comparison to previous research, provide insight into future research, address limitations, and draw conclusions. Overall, it is hoped that participants lived experiences will lead to new ideas and insight into the world of figure skating and concussion risk.

5.1 Superordinate Theme 1: Concussion Consequences

5.1.1 Acute Consequences

Figure skaters appear to have a general understanding of both the acute and late/chronic side-effects and symptoms of concussions. However, they were less familiar or perhaps less willing to disclose the long-term/chronic side-effects. Most skaters were able to share a basic understanding of symptoms associated with a concussion. However, the skaters with a broad knowledge of symptoms tended to be the ones who had experienced a concussive event. This is similar to Nanos et al. (2017), which reported those who had experienced concussions were confident in their symptom knowledge. These findings are in contrast to Kristjánsdóttir et al. which stated that female athletes were highly uneducated in the understanding of concussions (2020). These athletes were current and former in the following sports soccer, handball, basketball, ice hockey, and combat sports (Kristjánsdóttir et al., 2020). In this study the male participant was highly educated as well as the females. However, the females showed hiding concussions for competition as well as both quick return to play along with medical timelines.

5.1.2 Chronic/Long-Term Concussions

Nanos et al. (2017), reported those who had experienced concussions were confident in their symptom knowledge. They also reported that overall females, healthcare employees, and parents were more concerned with the long-term effects, but knowledge between males and females was not significant (Nanos et al. 2017). Athletes regardless of sex were more concerned with return to play timelines. Furthermore, while skaters identified several long-term effects of concussion, they did not name two significant long-term complications of concussive events, namely PCS or CTE (Hobbs et al., 2016). While it is not clear why figure skaters did not mention either PCS or CTE, it is possible that figure skaters may perceive both as a "contact sport" problem (Yadikar et al., 2019) and were consequently not expressed as a concern. Alternatively, it may be a lack of a full understanding of the longer implications of a concussive injury. Nevertheless, while athlete-to-athlete contact is limited, collisions between athletes and contact with the ice does put the figure skater at risk of suffering a concussion. Whether or not CTE has occurred in this cohort is unknown, but with concussions being a modality of the disease, it is not impossible.

5.2 Superordinate Theme 2: Skating Safety Education and Awareness

The superordinate theme Skating Safety Education and Awareness was derived from three subordinate themes: Understanding Risk, Need for Greater Awareness and Education, and Coaching Certification. These subordinate themes are contrasted against pre-existing literature.

5.2.1 Understanding Risk

Figure skaters in this study understood risk primarily in relation to their own experiences. Similar to Adame & Corman (2018) who found that a vested interest predicted 36% of perceived risk and self-protective behaviors, the personal experiences of participants in the current study largely shaped participant knowledge, attitudes and beliefs towards concussion risk and prevention. Specifically, skaters with a history of a concussive injury were more likely to have greater knowledge

of how a concussion might impact their overall well-being. Moreover, skaters who have endured concussion related complications tended to view the sport as high risk.

To date, few studies have explored the lived experience of figure skaters with respect to understanding concussion injury risk

How figure skaters view risk may be relative to their experiences, therefore, perceptions vary from individual to individual. In the current study, participants had mixed opinions with respect to concussion risk. Some suggested that novice skaters were at the highest risk, while others noted that advanced/elite skaters are more at risk as they learn risker techniques such as double and triple axels. Some commented that "it depends on the skater" suggesting that experience is preventative but note that injuries can happen to anyone. What is clear is that both inexperienced/novice and experienced skaters are not without risk (King et al., 2017).

Many skaters in this study noted hitting their head on the ice, but not thinking they've experienced a concussion. Furthermore, many skaters would like more ways to detect concussions. Efforts to improve risk awareness may be aided through the creation of a visual detection study. This could be done by using footage of skaters who have received a diagnosed concussion and using a match-based game to see the percentage of correctness. From there, researchers could make recommendations as to how to increase correctness score. It appears there is a base education that needs refinement in order to create the safest environment for skaters (Gretchen et al., 2018; Cusimano et al., 2018), this education consists of videos and tutorials, but appears to lack in-world examples especially for the figure skating cohort. Cusimano et.al., (2018) notes that the Canadian concussion educational resources improved post-survey concussion knowledge scores this (pre-test/post-test). This was a multitude of tests including the Hockey Canada Concussion Mobile App/Children's App, programming by the Coaching Center of Canada, and a series of information courses by Canadian Center for Ethics and Sports. Overall, the data suggest that while most

participants recognize the risk of concussion in their sport, additional education, awareness, and risk reduction strategies are needed.

5.2.2 Need for Greater Awareness and Education

Athletes, and coaches all need to make the risks well known and not downplay the potential severity of concussive injuries. Skaters on synchro teams noted not wanting to let teammates down as a reason to returning to competition as soon as possible. This led to the hazard of not reporting and skating with a possible concussion. However, the social support between injured skaters and their teammates was noted as an important component of the healing process. One skater mentioned how everyone at the rink missed her and it was helpful just to sit in the coaches' box to have the support while recovering.

Additional education needs to reach coaches in being more aware of the risks and need for skaters to take a step back when needed. The coach's role and responsibility as an advocate for their athletes cannot be understated, but often are motivators for returning to play too soon and failure to report. In Kroshus et al., (2015), coaches encouraged skaters to return to sport too soon as well as encouraged behaviours that lead to failure of reporting a concussion.

Participant 3 said the lack of protocols allowed her to go to the rink the next day after sustaining a concussion. Participant 18 threw up and had a headache after the injury, but the next day felt fine to skate and did. This shows that there are symptoms that span to concussions but may not be readily known by the individual. However, several skaters did report instances of hitting their head on the ice, but never suspecting a concussion, perhaps remaining asymptomatic, did not seek out any medical consultation. Without a doctor's diagnosis, this can only be speculative, yet these individuals could have faced serious injury and not even be aware.

Finally, skaters need to look out for other skaters. In synchro skaters are teammates, and that social support should extend to the training of skaters to spot concussions and potentially be an

advocate for each other. Participants that knew, yet did not report, chose to do so in order to not let those around them down. Thus, teammates may play a more prominent role in concussion awareness and prevention than previously realized. Similar to Kroshus et al. (2015) who found that teammates, coaches, and other stakeholders played an important role of influence in seeking medical care for concussions which is consistent with the influence of coaches and teammates in this study.

In a hockey cohort, fighting through injury despite doctor's orders is seen as resiliency (Cusimano et al., 2013). The attitude of resiliency was not noted by the figure skating cohort in this study when relating to concussion injury. The lack of seeking medical care could also be due to coaches and parents as a form of key stakeholders and their views need to be explored in greater detail. Coaches are included in this cohort, but only skaters' accounts detail discouragement for seeking proper diagnosis due to competition. A recommendation by Anderson et al., (2021) noted to include the dangers of continuing to play, long-term consequences, and transparency about concussion protocols thus creating a need for further education and awareness. Moreover, with biased and/or inconsistent reporting it is unclear how many concussions are experienced in competitive level figure skaters (King et. al., 2017). To improve awareness – there is a need for better tracking of injuries.

5.2.3 Coaching Certification

Coaches receiving concussion education is not required in all sports in the United States (Kroshus et al., 2016). Yet, there is a great importance to coaches receiving this training as it helps them better spot symptoms as well as creating a safer return to play strategy for athletes (Kroshus et al., 2016; Feiss et. al., 2020). Even a coach saying, "Hey, you took a nasty fall, go see the doctor just to be safe," could make a world of difference in the outcome of a skater. If a skater chooses not to seek medical care, then it is on the skater. Another potential solution could also include SafeSport adding a video-match element to the certification using a match system with examples of the falls that need to have the skater pulled and referred to a doctor for examination and medical clearance.

Coaches are so vital to figure skating and "I had a really supportive coach" can make the difference in the quality of recovery a skater experiences after a concussion. Therefore, equipping coaches with the tools to protect skaters and create a thriving and safe training environment is necessary to the future of this sport.

5.3 Superordinate Theme 3: Risk Reduction

The superordinate theme Risk Reduction emerged from the following subordinate themes: Falling Backward Core Strength, Not Much Can Be Done (Hazards of the sport), Protective Equipment, Referral and Medical Oversight, and Technique. These subordinate themes are contrasted against pre-existing literature.

5.3.1 Falling Backward Core Strength

Uncontrolled falls without a doubt pose the highest risk of concussion in singles figure skating (REFs). However, there are many reasons as to why a skater falls such as ice quality, technique, athlete fatigue, underlying injuries, and distractions. Core strength was mentioned multiple times by numerous participants. The importance of core strength is established in figure skating training (Advanced Solutions International, 2022), but the idea of using the core to tuck and reduce concussion risk has not been explored. However, the implementation of a mobility, speed, agility, stability, and strength training program was shown to reduce the occurrence of concussions in football, soccer, and volleyball athletes (Morrissey et al., 2019).

In additional to core strength, neck strength has been demonstrated to help reduce concussion occurrence (Elliott et al., 2021). Specifically, Elliott et.al., (2021) found that among all preventative measures, neck strength provided the most protection. This means that having a stronger neck versus the circumference of the neck, offers the most protection for the cohort studied. Similarly, the strength aspect is in addition to the findings of Dezman et al., (2013) noting the symmetry in neck flexors and extensors reduce risk and injury by the reduction of acceleration. This use of neck strength is also

seen in Collins et al. (2014). Collins et.al (2014), showed that every extra pound of neck strength measured by pulling on a tension scale to maximum force resulted in a decrease in the odds of a concussion by 5%. In the same study, reduced neck strength and smaller neck to head mean circumference was also a predictor of being more likely to sustain a concussion (Collins et al. 2014). These elements may be factors playing into areas that could have improvement for risk reduction.

5.3.2 Not Much Can Be Done (Hazards of the sport)

"Accidents happen" is a mentality that may be creating a tendency not to take concussions seriously. Skaters did not elaborate much on what makes accidents happen apart from landing a jump wrong, losing your footing, and collisions with other skaters. However, accidents could also be due to ice quality and equipment issues.

Many skaters note falling backwards as well as hitting their head on the ice, but don't think they've sustained a concussion. This study has instances of skaters who have potentially suffered a concussion through unexpected falls (whiplash mechanism) or by hitting their head on the ice and may have suffered a concussive event but did not seek medical attention. No information was provided by skaters as to why they did not seek medical care apart from a few cases were the coach and competition the next day influenced their decisions not to report.

In addition to athlete training and willingness to wear protective equipment, facilities also need to take into consideration the number of skaters on the ice with increased numbers increasing the risk of athlete collisions. The factors underlying why skaters collide was not explored but is an area worthy of additional exploration. Potentially, it could be a stand your ground attitude of the sport taught by some coaches as well as coaches emphasizing the other skater will stop. However, the other skater may also be receiving a similar message. There may also be a lack of spatial awareness and reaction time does prevent concussions (Honda et al., 2018). During a busy session, focusing on

practice as well as avoiding collisions is a continuous balancing act. Yet, in this sport, skaters noted there is only so much that can be controlled.

5.3.3 Protective Equipment

While protective equipment would mitigate the injury of hitting their head on the ice, there is still the whiplash movement associated with falling backwards. Skaters noted the whiplash motion as a modality of concussions, but whether or not skaters could successfully see these events as concussive in the field is unclear. In-line roller-skating adopted protective equipment as a medium to reduce injuries and hospitalizations (Connaughton & Barbello, 1999), and this intervention helped with hospitalization rates. While education and proper instruction was noted as reducing risk, the addition of helmets reduced the severity of head trauma and as a result protective equipment is still recommended (Connaughton & Barbello, 1999).

Consistent with the perception that novice skaters are most at risk, McGeehan et al. (2004) recommend that children should always wear a helmet when ice-skating. Some skaters in this study note novice skaters should always have a helmet, but as expertise increases, the protection disappears, which appears to be dangerous and unnecessary. The why of increase time in sport and removal of such equipment needs to be explored in future studies.

The current head protection designs such as the cushion bands, not even helmets, aren't what skaters like even protective head gear was identified as a legitimate need for high-risk individuals. What is clear is some skaters are absolutely for them, while others are not. Although not mentioned in the current study, how a helmet could change the way a skater trains is a point of future study. In this study, many figure skaters were skeptical about the use of protective equipment because they believed they weren't allowed to wear any protection. The thoughts and explanations behind why skaters "aren't allowed" to wear pads was not elaborated on. However, in the researcher's experience generally it is because the pads may act as a security blanket. When the pads are taken away for

competition (any padding is generally for practice only), then it creates a mental block. Moreover, protective equipment such as a helmet isn't viewed as an aesthetically appealing option, citing that education and core strength are enough to mitigate risk. However, what is defined as proper technique was not specified, and created a subjective angle to what works.

Previous literature has noted the use of policy and protective equipment to be a useful tool in preventing concussion in contact sports such as hockey (Emery et al., 2017) and non-contact sports such as cycling (Provvidenza et al., 2013). Benson et al. (2013) noted that there needs to be a multifactorial approach. This study also noted that headgear for rugby players made no difference (Benson et al., 2013), which displays how difficult protecting athletes from concussions can be. Further consideration should be use of helmets in a Canadian Hockey cohort was viewed as a solution in early stages. Then as time and research went on the helmets fostered more risk due to increasing dangerous behaviors. This was due to the illusion of a helmet creating full protection against head injury and concussions (Cusimano et al., 2013). Helmets prevent skull fracture but does not fully provide protection against concussions (Cusimano et al., 2013).

5.3.4 Referral and Medical Oversight

Participants noted that access to a medical professional would be beneficial, but the professional would likely have to have the authority to pull players if a concussion was suspected. In the athletic trainer study, athletes knew more about concussions, yet still did not report due to not wanting time off from their sport, not wanting to let the team down, as well as not viewing concussions as a serious injury (Wallace et al., 2017). The Wallace et al. (2017), study findings were very consistent with the participants in this study.

A medical professional in the rink may be a good mediator to solve when to pull an athlete from the ice, however, the medical professional would need to be firm in their knowledge/expertise of spotting concussions especially if there is conflict as to whether an athlete is fit to train. There are

many accessible tools that healthcare providers use and are available through the Concussion Collection (Concussion Resources for Health Professionals 2021), but are also highly valuable to coaches, parents, and athletes. As in other competitive/professional sports, the medical professional could potentially take the power from the coaches', athletes', and parents' hands. However, the reverse was seen in an NHL player's experience having a team doctor push him back onto the ice after concussion (Caron et al., 2013). Therefore, the focus of what's best for the athlete is where all parties need to come to agreement. This means pulling skaters when there is a competition on the line, even if all parties want to put the sport first.

Orthopedic surgeons are trained to notice the slightest difference that could indicate a concussion (Jildeh et al., 2020), making them extremely valuable to have on the sideline. However, having highly trained professionals on the side-lines is likely not feasible on a large scale. Thus, coaches need to be educated in figure skating specific safety training similar to that of CPR. There is some baseline training for detection, but what to look for in the field does not appear to be currently taught and in competition is frequently ignored. What will help enact athlete first medicine is a point of further study.

5.3.5 Technique

King (2005) studied the ways to improve off-ice for jumps as the rise of technically difficult programs have become more prominent. King discusses the study focuses on the take-offs (beginning of the jumps) rather than the landings, and the utilization of off-ice practice for both upper and lower body strength (2005). Future studies need to look at landings as well other elements of the sport for each level to improve the methodology of techniques and the way they are taught.

Despite the findings of Wang (2015), who reported that figure skaters may experience "micro-concussions" resulting from prolonged G-forces association with repeated spins, skaters in the current study did not perceive spins as a high-risk element of figure skating. While prolonged G-forces and

micro-concussions has not been fully explored in figure skating, it is notable that acceleration as low as 33G affects white matter in contact sports (McAllister et al., 2013). Wang (2015) noted that figure skaters can experience as much as 4G in high velocity spins. While well below 33G, the prolonged and repeated nature of the spins may have a lasting impact. While participants did not identify high velocity spins as a potential risk factor leading to a concussive injury, additional study in this area appears to be warranted.

Specific techniques that foster skaters learning new techniques and transitioning to more complicated skills without injury were not explicitly stated by participants. Respondents in this study noted there needed to be more mediums of learning for techniques. Techniques such as using the harness, rink wall for stability, as well as off-ice were mentioned, but not discussed in detail. A consideration is the importance of having a vast toolbox for teaching and learning is individuals with a concussion history are well-known for experiencing learning difficulties (Ilie et al., 2020).

5.4 Strengths, Limitations, and Considerations

Strengths

The researcher is from the figure skating cohort. Regarding the language and context, it is a strength to have an insider as well as a fan of the sport. Strengths of this study involved the use of thematic analysis and allowing the data for speak for itself (Braun & Clarke, 2006). This work adds important insight into the experiences of competitive figures skaters with respect to concussions.

The inspiration for this research grew out of the researchers experience as a competitive figure skater who, having suffered a concussion while skating, has a desire to improve athlete safety. Building on her personal experiences, it is hoped that research will inform athletes and coaches of the importance of concussion risk mitigation and management in figure skating. Figure skating's artistic integrity was considered as the sport is not only artistic in foundation, but there is also a high amount of athleticism that warrants methods of protecting skaters' health. This means that the researcher

understands from the artistic standpoint skaters would not want to wear a piece of equipment that throws off the skaters' outfit and style of the program. However, the researcher also acknowledges that the skaters' health and safety come first, even if it is not fashionable. As a result, the blend of both function and fashion should ultimately be considered.

Limitations

The limitations of this study involve drawbacks due to the lack of male involvement in the sport. The male in this study's cohort had vast concussion knowledge in and out of figure skating. However, other males may have had differing experiences, views and opinions that were not captured in the current study. This study only captured ages 18-38, but many skaters start young and end their careers at an early age. This age of retirement is often around 20-25, whereas early 30s is often on the higher end of retirement. Insights of younger skaters and their parents is an area worth of further exploration.

Considerations

This study explored the world of figure skaters and their lived experience with concussions. Figure skaters' perspectives and experiences are valuable to future literature as a cohort that has received minimal attention in the literature. In qualitative research, the transferability is known as a case-by-case occurrence, but the researcher must provide a rich and thick description (Nowell et al., 2017). The rich and thick description allows for an individual to provide judgement to transferability (Nowell et al., 2017).

In the United States, the NFL has shown that down the road, athletes want compensation for damages. Whether or not figure skating athletes would do the same is unknown, or if it would differ from the US to Canada. However, some liability insurances are not covering figure skating anymore due to the increase in concussion claims (Epic entertainment and sports: Professional skaters association 2021). If "everyone is involved" as said by numerous participants, then skaters potentially

may need insurance to cover legalities because they did or did not tell their friend at the rink to seek medical help. The reason why talking about concussions was previously "taboo" may ultimately be because of lawsuits. Sustaining a concussion means loss of work and loss of wages, and potentially long-term damages. But coaches not utilizing and promoting tools to prevent concussions and hurting recovery by brushing the injury off from these incidents will lead to a far worse outcome. These factors warrant more in-depth research and analysis.

This study observed that both coach and athlete concussion awareness and education is still an area in need of greater attention. Many of the figure skaters were aware of concussions and their relation to the sport of figure skating. While no skaters linked spins to G-force concussion possibilities (Wang, 2015), several participants perceived jumps as a notable factor in increased concussion risk. Similar to King et al., (2017) a couple of skaters who reported having never sustained a concussion, stated that concussions were not as high of a concern as other injuries, such as overuse injuries. This finding could be due to factors such as an athlete hesitancy to report or downplaying concussion risk or lack of experience creates an association of lack of risk (Weber et. al, 2019).

In a study of coaches and parents, those presented with online modules (audio/video elements) struggled with recognition and preparedness in the field, however, the in-person/online hybrid provided a higher degree of success in spotting a concussion (Feiss et al., 2020). Visual training of which falls are of concern needs improvement, specifically hitting the head on the ice and whiplash motions of the head and neck.

Most skaters had not received any sport-specific concussion training and rely on their coach's input/expertise. One participant mentioned skaters are aware of concussions, however, some skaters may very well know they've had a concussion but will not take themselves out of the sport. This further acknowledges the gaps in education and sport-specific protocols (Adame & Corman, 2018). Athletes appear to be highly knowledgeable about concussion risk (Adame & Corman, 2018), but

there appears to be a disconnect between what they know and what they do. For example, it took a broken ankle (Participant 2) for her to even think she had a concussion when the doctor noticed she exhibited symptoms. Stories of hitting one's head on the ice and moving on was present in those who participated in this study. Many showing concern for how to do better. The skaters with a higher degree of concussion knowledge as well as emphasis on a proper healing timetable were the ones who had sustained a diagnosed concussion.

Parker et al. (2015) reported that athletes who received concussion awareness training, such as Head's Up, exhibited behavior change as well as self-reported better recognition that could change the culture of many sport domains (Parker et al., 2015). Training for athletes and coaches is an area for improvement. However, risk is not always a predictor of reporting, and several accounts in this study support the findings of Doucette et al., (2021) who found more competitive athletes were less likely to report or see a doctor. Notably, a recommendation is that doctors should be aware that elite athletes are extremely knowledgeable regarding concussions yet are most at risk for concussion nondisclosure (Doucette et al., 2021).

5.5 Conclusion

"What are the experiences, knowledge, attitudes, and beliefs of current and former figure skaters relating to concussions?" led to stories of concussions, education, coming back to the sport after concussion, methods of preventing concussions, and analysis of risks involved. Three major themes emerged: 1) Complications Due to Concussions, 2) Skating safety education and awareness, and 3) Risk Reduction. The findings from this study provides insight into the perceived risks and potential strategies to reduce figure skaters' risk and management of concussive injuries. Ultimately, similar to other competitive sports, figure skating needs to adopt a culture that accepts that it is okay to take time to heal. Empowering skaters with tools to protect themselves on the ice will allow for

longer careers. Furthermore, enabling skaters to be in the sport longer benefits the figure skating body as a whole. The overall goal is to create a safe and enjoyable figure skating environment.

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Appendix A

Interview Guide
A Qualitative Inquiry on Competitive Figure Skaters' Perceptions of Concussion Risk and Injury Prevention

Introduction: Hello [participant name]. My name is Caroline Frost and I want thank you for taking the time to meet with me today. As a reminder, I am interested in learning more about your attitudes and beliefs relating to concussion risk, injury management, and preventive measures in competitive figure skaters. Competitive Figure Skaters in this study is anyone who has competed at any level in any programs, from any figure skating organization.

As both a figure skater and fan of the sport, I have become very interested in exploring athletes' views and beliefs regarding the relationship between competitive figure skating and concussion risk, injury management, and prevention.

Section I: Background

Before we jump in, please tell me a little about yourself, beginning with how old you are. Next, can you tell me…

5.5.1 Tell me about when you were first introduced to the sport of figure skating? How old were you?
5.5.2 What attracted you to the sport?
5.5.3 How long have you been training/competing in the sport?
5.5.3.1 At what level(s) do/have you competed (regional, national, international)?
5.5.3.2 Are you still actively training/competing?
5.5.3.2.1 If not, how old were you when your retired from skating?
5.5.3.2.1.1 If you are no longer training/competing, why did you retire fromcompetitive skating?
5.5.3.2.1.2 Do you still skate for leisure? Why/why not?
5.5.3.2.1.3 Do you continue to have any involvement with figure skating(coach, parent)?

Section II: Exploring Concussion Knowledge

Now that I know a little more about your time as a figure skater, I would like to explore your understanding of concussions. In your own words …

1. Could you describe to me what a concussion is?
2. What do you believe causes a concussions?
3. What types of symptoms might an athlete suffer is they have experienced a concussion?
4. What do you believe are the possible long-term consequences of having suffered a concussion?
5. Have you ever been offered or received any training/education on concussion? (injury prevention, management, etc.)

    a. If yes, please tell me more about the training that you received.

b. If no, would you have wanted the opportunity to receive concussion training/education?

Section III: Figure Skating and Concussion Risk, Prevention, and Management

6. What are your thoughts on figure skaters' risk of concussions?
    a. What elements of the sport do you feel might put the athlete at risk of a concussion? (PROMPTS: falls, spins)
        i. In your opinion, how well do you feel concussive injuries are managed in competitive figure skaters? (PROMPTS: awareness/education initiatives; protective equipment; return-to-play guidelines)
        ii. What (additional) strategies might be implemented to reduce concussion risk in figure skaters?
        iii. Who do you perceive plays an important role in managing concussion risk in competitive figure skaters (PROMPTS: other figure skaters, coach, organization, governing bodies)
    b. **OR**, if you feel that figure skaters are at low or no risk of suffering a concussion please explain why (PROMPTS: training – e.g., learning how to fall).
7. Compared to other injuries that a figure skater might suffer, in your opinion, how serious is a concussion? What are your thoughts as to why?
8. If you have ever knowingly or thought you may have ever suffered a concussion while figure skating…
    a. How did you know that you had suffered a concussion? (PROMPTS: symptoms, diagnosed by a physician)
    b. Having suffered a concussion, did you ever feel pressured to return-to-your sport before you were fully recovered?
        i. If yes, please describe the reasons why (PROMPT: pressure from peers, coaches, fans, self).
        ii. If no, what supports did you receive to help manage the concussion?
9. Do you feel like there is anything else related to concussions and figure skating you would like to add? Or anything you would like to touch on?

Closing: Thank you for your time today. This finishes up the questions for the study today. Your time and opinion are of great value.

Appendix B

Recruitment Poster

COMPETITIVE FIGURE SKATERS WANTED FOR A RESEARCH STUDY!

Competitive figure skaters are needed to explore their attitudes and beliefs with respect to perceived concussion risk, injury management, and the use of preventative measures (e.g., protective equipment, training adjustments, education, etc.) in reducing concussion risk. Eligible participants will be invited to complete a **one-time interview** by phone or video conference. Interviews last about 45-60 minutes. ***No prior concussion history or knowledge is necessary.***

You may be eligible to participate if you identify as a current or former competitive figure skater who:

1. Has trained for a minimum of 12 months, and
2. Have competed at regional, national, and/or international competitions.

For more information or to volunteer to participate please contact Caroline Frost, MSc Candidate at CR373975@DAL.CA. Participants will receive $10 Starbucks Card.

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Appendix C

Social Media Post

Competitive figure skaters needed in study seeking to understand the lived experiences of figure skaters relating to concussions. Eligible participants (18+ years) will be interviewed about their attitudes and beliefs regarding concussion risk and concussive injuries in competitive The interview will take about 45-60 minutes to complete. For additional details and information on how to get involved please contact Caroline Frost at CR373975@DAL.CA.

Appendix D

Recruitment Email

SUBJECT: Concussive risk and Concussive Injuries in Competitive Figure Skaters

Dear Athlete,

My name is Caroline Frost and I am a master's student at Dalhousie University based in Nova Scotia, Canada. As a part of the Master's of Science degree in Kinesiology, I am investigating the experiences of figure skaters in relation to concussion risk and concussive injuries. Specifically, I will be exploring your lived experiences as a figure skater with respect to concussion risk and concussive injuries. To be eligible to participate in the study, you must be a competitive figure skater that has competed in a figure skating organization's competition (ISU, Skate Canada, US Figure Skating, etc.) performance over the age of 18 years.

If you agree to participate, you will be asked to complete a one-time interview lasting approximately 45-60 minutes. The interview will be conducted by myself by phone or video conference. This study is conducted under the supervision of Dr. Melanie Keats at Dalhousie University in Nova Scotia, Canada. If you are interested in learning more about the study or how to get involved, please contact: CR373975@dal.ca.

Sincerely,
Caroline Frost
Department of Kinesiology
Dalhousie University
USA: (352) 213-1402
CR373975@dal.ca

Dr. Melanie Keats
Department of Kinesiology
Dalhousie University
Canada: (902) 494- 7173
Melanie.Keats@dal.ca

Appendix E

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Informed Consent Form

Project Title: Exploring the lived experiences of competitive figure skaters relating to concussion risk, injury management, and prevention?

Lead Researcher: Caroline Frost, Dalhousie University, CR373975@dal.ca

Supervisor: Dr. Melanie Keats, PhD Dalhousie University, Melanie.Keats@dal.ca,

Introduction

We invite you to take part in a research study conducted by Caroline Frost, a graduate student under the supervision of Dr. Melanie Keats at Dalhousie University. Choosing whether or not to take part in this research is entirely your choice. There will be no impact on your status, or associations in sport if you decide not to participate in the research. The information below tells you about what is involved in this particular study, what you will be asked to do, and any possible benefits, risks, and discomforts experienced.

Any questions or comments you have about this study discuss with Caroline Frost, and please ask as many questions as you would like either now or later.

Purpose and Outline of the Research Study

The purpose of this study is to examine athletes' beliefs and attitudes towards concussion risk, injury management, and prevention in competitive figure skaters. The findings from this study will be used to better understand perceived risks and potential strategies to reduce athlete risk and management of concussive injuries.

Who Can Take Part in This Research Study

You may participate in this study if you:

1. Are above the age of 18, and
2. Have figure skated competitively. *
   *Competitively is defined as having participated at any competition (regional, national, international) which you were judged or ranked. ISU (International Skating Union), Skate Canada, and U.S. Figure Skating provides tests and competitions, which anything similar or under this umbrella with verification of competition will be accepted.

What You Will Be Asked To Do

If you agree to participate in this study, you still be asked to complete a **one-time interview**. The interview will be conducted by phone or video conferencing (e.g., Skype, MS Teams, etc.) and will last about 45-60 minutes. The interview audio will be recorded and transcribed verbatim. We will ask you to turn off your video camera during the video conferencing to better maximize your confidentiality.

Possible Benefits, Risks and Discomforts

Your participation in this study may not directly benefit yourself, but your contributions may provide insight on how to make the sport safer.

While minimal, the risks to participating may include the recall of some stressful life events (e.g., suffering a career ending injury). Should you find any questions too upsetting, you may choose to withdraw your participation or refuse to answer any questions that make you uncomfortable.

During the interview, if you discover that you may have unknowingly suffered a concussion and are suffering from the late effects of a concussion, we would strongly encourage you to seek the appropriate medical advice.

How Your Information Will Be Protected:

The telephone or video conferencing video will be audio recorded and transcribed verbatim. You may turn off the video portion of the video conferencing interview should you not want your image recorded. Pending the completion of the interview, the audio recording will be downloaded and stored on a password protected computer. Any identifying names or personal information (e.g., skating club identification, etc) will be removed from the final transcriptions and a pseudonym will be used in its place. Audio recordings will be deleted as soon as they are transcribed. Transcribed, deidentified interviews and subsequent data will be kept on a password protected computer and only used toward the purpose of this study. Following the completion of the interview, you will have two weeks to withdraw your interview data, after which point your data will have been anonymized and we will no longer be able to identify your data for removal.

All of the information provided during the interview will be kept private. Only the research team at Dalhousie University will have access to this information. We will describe and discuss our findings in presentations, as well as journal articles. Furthermore, we will also talk about group results so that no one is identified. In other words, ***you will not be identified in anyway in the reports. However, you will be able to follow-up with the researcher and provide insight into analysis.*** The people who work with us have an obligation to keep research information private. Also, we use a participant number, in our written and computer records so that the information contains no names. All identifying information is securely stored. All electronic record will be kept secure via encrypted files on the researcher's password-protected computer.

If You Decide to Stop Participating

You are free to stop the interview at any time. If you decide to stop the interview, you may also have any information collected to that point removed from the study. You may also decide to have the use of this data removed for up to two weeks after the interview. After that time, it will not be able to be able to be removed as it will be anonymized.

How to Obtain Results

No individual results will be provided. You can obtain a summary of the study findings by contacting Caroline Frost through email at CR373975@DAL.CA or contacting Dr. Melanie Keats at Melanie.Keats@DAL.CA.

Questions
Please do not hesitate to ask any questions or communicate concerns you may have about participation in this research study. Contact Caroline Frost at CR373975@DAL.ca at any time with questions, comments, and/or concerns about this research study. Furthermore, any new information that may change the decision to participate will be communicated to you. Any ethical concerns about participation in this research, you may also contact Research Ethics, Dalhousie University at (902) 494-1462, or email: ethics@DAL.ca and reference REB File # REB File #: 2021-5588 V3.0 August 25, 2021
.

Signature Page

Project Title: Exploring the lived experiences of competitive figure skaters relating to concussion risk, injury management, and prevention?
Lead Researcher: Caroline Frost, Dalhousie University, CR373975@DAL.CA

Supervisor: Dr. Melanie Keats, PhD Dalhousie University, Melanie.Keats@DAL.CA,

I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I understand that I have been asked to take part in a one-time interview that will occur via telephone or video conferencing. I also understand that my interview will be recorded. I understand direct quotes of things I say may be used without identifying me. I understand that by completing the interview that I am consenting to take part in this study. I give verbal consent and additional consent by my participation. My participation is voluntary, and I understand that I am free to withdraw from this study at any time, until two weeks after my interview is completed.

Do you agree to participate in this study? Are you ready to proceed with the interview now?

Researcher's Name	Signature	Date

Appendix F

Ethics Letters

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Health Sciences Research Ethics Board
Review Letter

Date: May 31, 2021

To: Caroline Frost (Melanie Keats), Kinesiology

The Health Sciences Research Ethic s Board has reviewed the following submi ssion for research involving human participants:

REB file#: 2021-5588

Title: A qualitative inquiry on competitive figure skaters' perceptions of concussion risk and injury prevention

The Board has found the project requires revision s and/or clarifications. When you have responded to this review, one electronic copy of the revised documents of your project must be resubmitted to Research Ethics at ethics@dal.ca in a single electronic file in MS Word or PDF format.

Your resubmission must include the following:

a) A cover letter that includes the recommended revisions/ clari fication s from this review letter and your respo nses to them. Each of the Board ' s comments should be immediately followed by a precise indication of how it has been addressed, including reference to the corresponding sections and page numbers in the submission; and,
b) The revised version of the submission itself, with each change highlighted for easy identification.

Upon receipt, your revised submission will be reviewed again . You may not begin your research until you receive an approval letter from the Research Ethic s Board. Board meeting deadline s do not apply to the review of these revisions. You may submit them as soon as they are complete. There are no review s in August. If no re-submission or communication has been received by our office within 90 days, the review will expire and a new submission will be required should you wish to pursue the st ud y.

If you have any questions, or require clarification , please contact Research Ethics at 902-494-3423 or by email at ethics@dal.ca.

RECOMMENDATION: Revisions and/or clarifications are requested.

2.4 INFORMED CONSENT PROCESS
2.4.1 The TCPS requires that consent be documented. Please outline a procedure for documenting explicit consent .

RESEARCH ETHICS • OFFICE OF RESEARCH SERVICES
Henry Hicks Academic Administration Building, Suite 231 16299 South Street I PO Box 15000 I Halifax NS B3H 4R2 Canada
902.494.3423 I FAX: 902.494.15951 dal.ca/ORS

Appendix G
Generated Themes

Superordinate theme	Subordinate theme
Concussion Consequences	Acute consequences (e.g., headaches, dizziness, loss of coordinate, sleep disturbances.)
	Long-term/chronic consequences (e.g., coordination, mentalhealth issues.)
Skating Safety Education and Awareness	Understanding risk
	Need for greater awareness and education
	Coaching certification
Risk Reduction	Falling and ccore strength
	Not much can be done (hazards of the sport)
	Protective equipment
	Technique

Appendix H
Hand-Written Code

SPEAKER1	02:40	and at what levels have you competed? Regional, national , international?
SPEAKER2	02:46	I have competed internationally in synchronized skating. And regionally and locally for singles skating, and nationally for ice dance.
SPEAKER1	02:57	Perfect, and are you still actively training or competing?
SPEAKER2	03:01	Umm, yeah, in synchro mostly
SPEAKER1	03:04	Now that I know a little bit more about your time as a figure skater, I like to explore your understanding of concussions. In your own words: Could you describe to me what concussion is?
SPEAKER2	03:16	Um, uh, I guess the way I describe it is like a brain injury resulting from an impact.
SPEAKER1	03:28	And what do you believe causes a concussion?
SPEAKER2	03:35	I guess I would be like the impact and maybe like swallowing or something.
SPEAKER1	03:41	And what types of symptoms might an athlete suffer if they've experienced a concussion?
SPEAKER2	03:52	I think headaches are pretty common. And maybe like a vision problems, memory issues. Yeah, trouble sleeping and other cognitive impairments at the processing time decrease.
SPEAKER1	04:16	No, you're good, it's in your own words. So, however you perceive it, there's really no wrong answer. And what do you believe are the possible long-term consequences of having suffered a concussion?
SPEAKER2	04:30	Oh. I would guess, just like I think there's occasionally like problems with learning disabilities. And like probably I would say like a continuation of, like, just the general symptoms that you would experience like pretty soon after expecting a concussion.
SPEAKER1	05:02	Wonderful. And have you ever been offered or received any training, special education on concussions? If yes, please tell me more about the training you received. If no, what would you have wanted the opportunity to look like?
SPEAKER2	05:15	Um, I don't think really gotten any concussion training. Um, I don't know what it would be nice to like. It would have been nice to have something like that.
SPEAKER1	05:34	Are there any specific formats or questions that you would have if you did have the opportunity?
SPEAKER2	05:45	Um. Yeah, I mean, nothing specific, I think just an overview probably would have caused me to generate some questions just by hearing like a lecture, like presentation or something.
SPEAKER1	06:02	And so now we're in Section three. It's figure skating and concussion risk, prevention, and management. So, what are your thoughts on figure skaters' risk of concussions?
SPEAKER2	06:15	I'd say pretty high, I know several people who have gotten concussions in skating, and many are severely impacted their ability to like continue school and continue skating. But it's honestly not as high as I would