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Implementation of an Evidenced-Based Concussion Management Protocol Utilizing

Telemedicine in a Student Health Center

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## Abstract

**Background:** An estimated 3.8 million concussions occur yearly in the United States and the incidence of youth concussions is on the rise. If untreated or unrecognized, more serious complications of concussions include post-concussion syndrome, second impact syndrome, and chronic traumatic encephalopathy. Clinic leadership in a southern California student health center identified systematic inefficiencies and noted a lack of standardized follow-up concussion appointment times which resulted in decreased clinic efficiency.

**Purpose:** The purpose of this evidenced-base project was to implement an effective concussion protocol and follow-up treatment plan that would improve clinic efficiency without negatively impacting concussion outcomes.

**Evidence-based Interventions:** A concussion management protocol was implemented utilizing evidence-based interventions to include standardized assessment of concussion, cognitive and physical rest as the mainstay of treatment, as well as staged return-to-learn and return-to-play recommendations. Follow-up appointments utilized telemedicine to improve clinic efficiency.

**Results:** The number of in-clinic face-to-face follow-up appointments decreased by 70%. Telemedicine follow-up times were on average 15 minutes less than the face-to-face follow-up appointment times improving provider and clinic staff resource utilization. There was not a negative impact on concussion outcomes or post-concussion symptoms.

**Implications for Clinical Practice:** The implementation of an evidenced-based concussion protocol and telemedicine for visits improved clinic efficiency and increased access to care without having a detrimental effect on post-concussive outcomes.

## Background

The incidence of youth concussions is on the rise (Pfister, Pfister, Hagel, Ghali, & Ronksley, 2016). It is estimated that 1.6-3.8 million concussions occur yearly in the United States, however, this number is difficult to estimate because as many as 50% of concussions are not reported (Choe, 2016). Although many definitions of concussion exist and a consensus has yet to be reached, Choe (2016), defined concussion as an injury from a biomechanical force that causes a multi-faceted pathophysiological process resulting in a detrimental effect on the brain. Post-concussive complications include a wide range of somatic, cognitive, mood, and sleep disorders including headache, dizziness, difficulty concentrating, memory impairment, depression, nervousness, irritability, and insomnia (Bramley, Hong, Zacko, Royer, & Silvis, 2016). While the majority of youth patients will recover from a concussion spontaneously with rest within 10 days, about 30% of patients will continue to have a myriad of symptoms. Adolescents may take as long as two to four weeks to fully recover from a concussion (Purcell, Harvey, & Seabrook, 2016). Additionally, a patient is placed at increased risk for further injury, worsening of symptoms, and longer period of symptoms if they return to activity before all of their symptoms resolve (Provance, Engelman, Terhune, & Coel, 2016).

If untreated or unrecognized, more serious complications of concussions include post-concussion syndrome (PCS), second impact syndrome (SIS), and chronic traumatic encephalopathy (CTE). In PCS, mild to moderate concussion symptoms persist for weeks to months causing substantial disability including adjustment disorder, depression, migraines, academic difficulty in college students, and significant disruptions in daily life (Bramley et al., 2016). Second impact syndrome occurs when student athletes or patients sustain a second concussion if they are returned to activity or sports prior to complete resolve of symptoms.

Second impact syndrome can often result in catastrophic brain injury and cerebral edema sometimes resulting in coma or death (McLendon, Kralik, Grayson, & Golomb, 2016). Chronic traumatic encephalopathy has received much media attention in the past few years because it is often seen in boxers, football players, and high-profile athletes who have sustained multiple concussions throughout their careers. It is defined as a progressive decline in cognitive functioning, mental health, and increased suicidality from repeated cerebral trauma most likely due to the long-term effect of multiple concussions. The changes are related to tau protein depositions similar to those in Alzheimer's and Parkinson's disease. Diagnosis and recognition of the disease can be challenging (Guiteau, 2017).

Timely assessment, diagnosis, and treatment of a concussion is imperative to prevent the detrimental sequelae and complications that can occur. Primary care providers are often the first to initially evaluate and assess the injury as well as manage the patient throughout their disease process (Arbogast et al., 2017). College students are particularly at high risk for post-concussive complications as they may not seek treatment or recognize that they have a concussion. Given the rise in concussion incidence and consequences of unrecognized or untreated concussions, providers must be well-educated on the timely assessment and proper management and follow-up of concussion symptoms.

### **Purpose**

From September 1, 2017 to February 1, 2018, a southern California collegiate health center assessed and treated 34 initial concussions and provided 47 follow-up visits. Clinic management identified systematic clinical inefficiencies in concussion management and noted a lack of standardized follow-up appointment times which resulted in decreased clinic efficiency. The goal of this evidenced-base project was to implement an effective concussion protocol and

follow-up treatment plan that will improve clinic efficiency without negatively impacting concussion outcomes.

### **Synthesis of the Evidence**

The literature review supported a theme of four general evidence-based interventions and guidelines necessary for effective concussion management: the use of a standardized assessment tool, cognitive and physical rest as the mainstay of treatment, graduated return-to-learn (RTL) and return-to-play (RTP) protocols, and the use of standardized processes for concussion management for primary care providers. In a systematic review conducted in 2014, King, Brughelli, Hume, and Gissane (2014), concluded that an accurate concussion diagnosis utilized a standardized evaluation method such as the Sports Concussion Assessment Tool (SCAT). The meta-analysis also presented evidence supporting graduated stages of RTL and RTP after a period of physical and cognitive rest as the initial treatment for a concussion. Additionally, the authors identified a lack of standardized management protocols which resulted in treatment variations amongst providers as well as lack of awareness and confusion regarding the different published guidelines that are available (King, Brughelli, Hume, & Gissane, 2014).

Another systematic review of the literature regarding concussion treatment determined that moderate physical and cognitive rest during the initial post-injury phase can improve symptoms and overall outcomes. The study further validated the importance of ensuring primary care providers have the most up-to-date knowledge and use best practice guidelines and evidence based practice when providing concussion care (Valovich McLeod, Lewis, Whelihan, & Welch Bacon, 2017). The Consensus in Sport Group developed expert consensus-based guidelines which were published 2017. The guidelines are based on systematic reviews, high-level evidence, and expert opinion. The group determined that the SCAT-5 is the most well-established

and validated instrument available for initial assessment of concussion. They further recommend physical and cognitive rest, and graduated RTL and RTP activities as the consensus standard for concussion management (McCrory et al., 2017).

In 2014, the Institute of Medicine report on concussions, published by Graham et al., reviewed the scientific literature on concussion screening, diagnosis, treatment, and management amongst many other aspects of concussions. Congruent with the above noted research, the report supported the use of a standardized concussion assessment tool for the initial evaluation of a concussion. Additionally, the authors determined that physical and cognitive rest should be initiated immediately after injury, followed by gradual return to cognitive and physical activities (Graham, Rivara, Ford, & Spicer, 2014).

In the past 10 years, the growing field of telemedicine has been shown to be a reliable and effective means to assess and manage primary care and specialty disorders such as heart failure, wound management, asthma, pain management, mental health, diabetes, and neurological disorders. Additionally, telemedicine has shown to improve clinical efficiency, decrease costs, and increase access to care for mobile and difficult to reach populations (Ekeland, Bowes, & Flottorp, 2010). More specifically, telemedicine has been used to remotely and effectively manage concussions and mild traumatic brain injuries (Cardinale, 2018; Vargas, 2015; Vargas, Channer, Dodick, & Demaerschalk, 2012). The military has also demonstrated telemedicine and teleconcussion as a validated means to improve combat-related mild traumatic brain injuries, improve efficiency, and decrease costs (Bell et al., 2015; Richardson et al., 2018). Suffoletto (2013) noted that patients who received text-messaging support and education following a concussion reported a decrease in post-concussive symptoms (Suffoletto et al., 2013).

## **Practice Change**

The project included implementation of a multi-faceted concussion assessment protocol utilizing the Sports Concussion Assessment Tool-5 (SCAT-5), cognitive and physical rest as the mainstay of treatment, and graduated stages of RTL and return-to-play RTP treatment protocols, as well as telemedicine to improve clinic efficiency. Under the new protocol, students presenting with a head injury or concussion symptoms were assessed in a face-to-face clinic visit for all initial concussion evaluations. An assessment utilizing the SCAT-5 assessment tool was conducted at the initial visit. Students with concerning neurological findings, neck pain, severe symptoms, and/or severe disruptions to daily life were referred to higher level of care to rule out an emergent health concern with instructions to follow-up in a face-to-face visit with their primary provider.

Students diagnosed with a mild to moderate concussion were prescribed cognitive and physical rest as the mainstay of treatment with graduated RTL and RTP guidelines until symptom resolve. Students with a negative neurological exam and mild to moderate symptoms were subsequently followed and evaluated by a single primary provider via telephone utilizing structured telemedicine, electronic health record documentation, and evaluation using the SCAT-5 22-item symptom severity scale to monitor improvement in three to five-day intervals. Additional plans for care were determined based on patient's recovery progress.

## **Implementation**

This evidenced-based project was an organizational priority. The Iowa Model was utilized to guide the implementation process. The project required multidisciplinary collaboration to create top-down change which are core elements of this model (Melnyk & Finehold-Overholt, 2014). Twelve staff members including providers, nurses, and medical



assistants were affected by the new process. The supervising physician and medical director of the clinic were the biggest facilitators and proponents for the process change in the organization. Campus Institutional Review Board approval for the project was granted exempt status in May 2018. The practice change began on September 4, 2018 at the beginning of the Fall 2018 semester. Staff education and the development of the educational tools, electronic health record documentation changes reflecting telehealth visits, as well as creation of standardized text messages, was completed in August prior to the implementation of the new protocol. Pre-data from September 1, 2017 to February 1, 2018, were collected as the best comparison regarding time and student demographics. Post-data were collected for data from September 4, 2018-December 21, 2018.

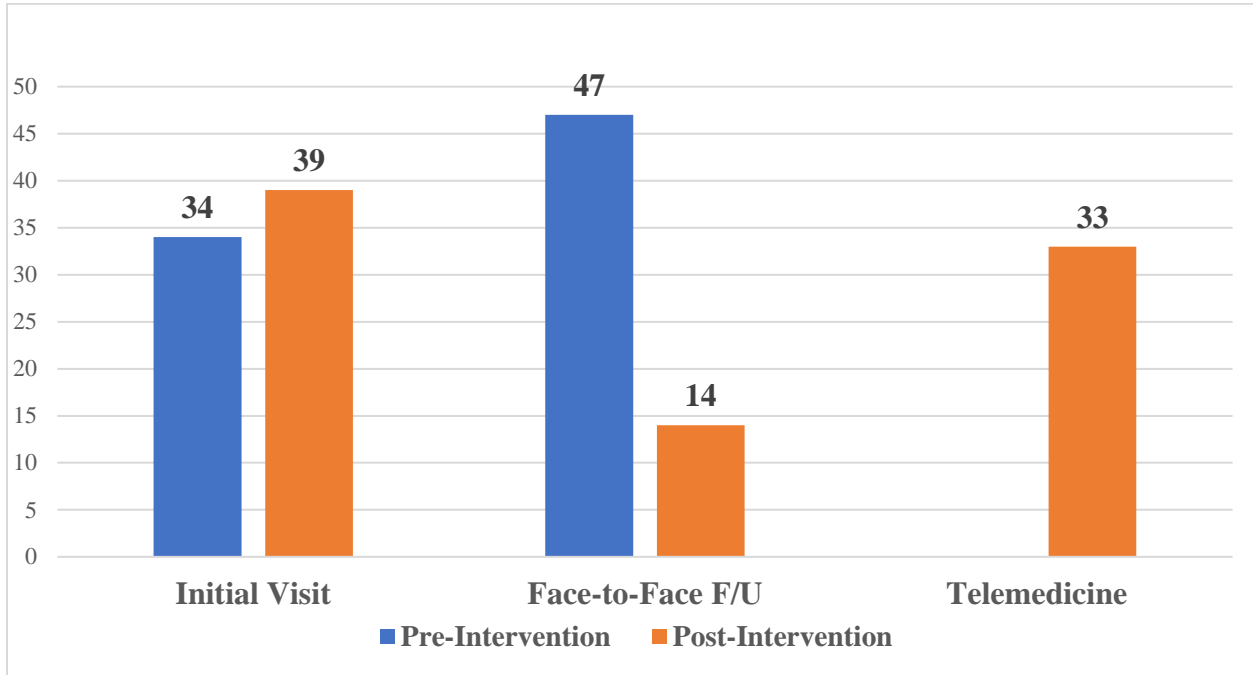
### **Outcomes**

Post-intervention outcomes were analyzed utilizing multiple data points pulled from the electronic health record to determine project effect. The implementation of an evidenced-based concussion protocol and telemedicine for (F/U) visits improved clinic efficiency and increased access to care without having a detrimental effect on post-concussive outcomes. The number of in-clinic face-to-face F/U appointments decreased by almost 70% which translates to increased availability of appointments and access to care for other patients seeking medical evaluation. Additionally, telemedicine follow-up times were on average 15 minutes less than the face-to-face F/U appointment times improving provider and clinic staff resource utilization.

Figure 1 compares the number and appointment types between the pre-intervention group and the post-intervention group. In the pre-intervention group, there were 47 F/U visits. All of them were face-to-face. In the post-intervention group, there were also 47 F/U visits. However, only 14 of them were face-to-face and 33 were telemedicine appointments. By utilizing

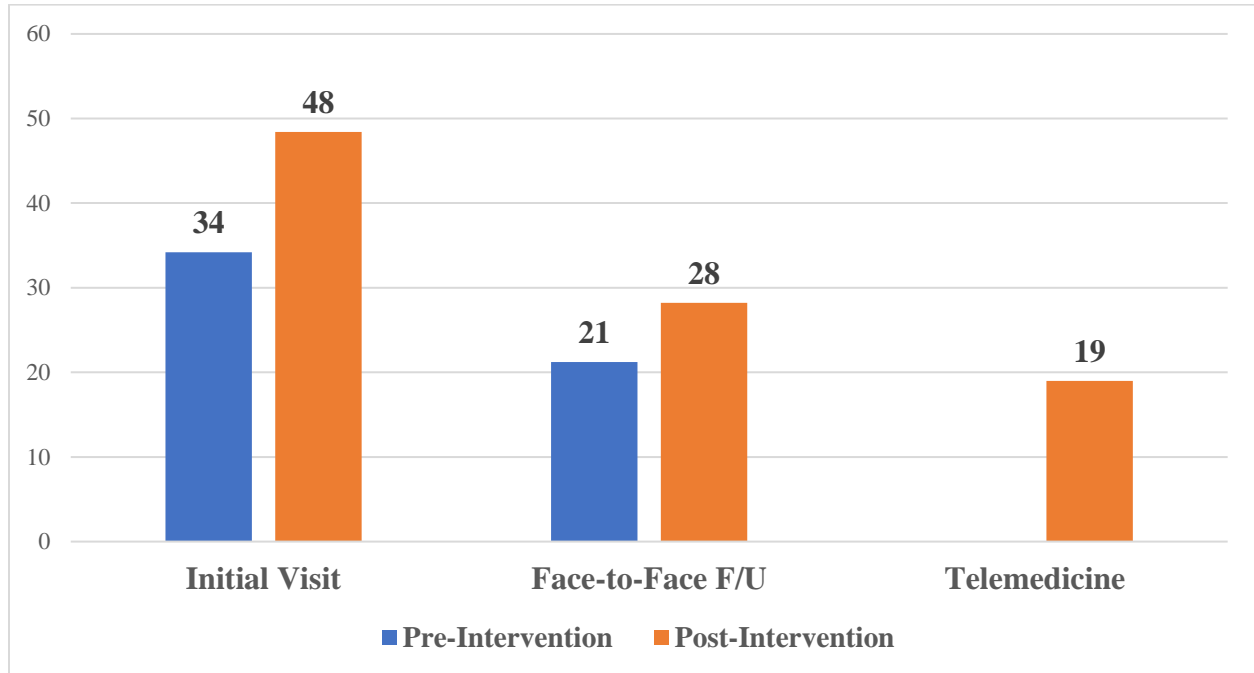
telemedicine appointments, the clinic increased access to care by thirty-three 20-minute appointments slots which is roughly 11 hours of face-to-face appointment time.

Figure 1. Number of Appointments by Type



Patient outcomes were also evaluated by analyzing patient symptom severity scores compared to appointment type. Figure 2 displays the average symptom severity score, measured by the 22-item symptom severity scale. The scale evaluates 22 different concussion symptoms from zero for mild symptoms to six for severe symptoms. The maximum score is 132. As expected, average symptom scores were highest during the initial visit with progressive decline in F/U appointments. Telemedicine appointments scores were the lowest when compared to pre-intervention and post-intervention face-to-face F/U scores, indicating a positive effect on concussion outcomes and symptom resolve. On average, there was not an increase in symptoms or worsening of symptoms when telemedicine was utilized.

Figure 2. Average Symptom Score by Appointment Type



To further evaluate concussion outcomes for telemedicine patients, referrals for face-to-face visits or specialized care were also analyzed. In total, 25 of the 33 telemedicine patients (88%) were ultimately cleared for full activity without further follow-up. Three telemedicine patients were referred for a face-to-face F/U with their initial evaluating physician and ultimately cleared. Five (15%) of the telemedicine patients were referred for further evaluation by a concussion, neuro, or mental health specialist due to worsening or slow improvement in post-concussive symptoms or other complication. Four of these patients had a history of anxiety, depression, and/or prior head injury which can complicate concussion recovery. Only one of the 14 patients in the face-to-face F/U group was referred for specialty care.

### Implications for Practice

The implementation of this project has multiple implications for practice. Most significantly, the execution of this project determined that the implementation of a standardized concussion protocol utilizing evidenced-based interventions and a specially designed telephone

follow-up protocol is a valuable method to improve clinic efficiency without causing a detrimental effect on concussion outcomes. Additionally, the use of telemedicine can improve clinic efficiency, enhance resource utilization, and increase access to care for highly mobile individuals or those out of reach of their normal primary physician.

However, it is important to recognize that certain limitations of this project exist. Some of the patients diagnosed with a concussion were not eligible to be evaluated for post-concussive F/U utilizing a telemedicine appointment. Those patients exhibiting neurologic red flags on initial assessment needed definitive follow-up care with a face-to-face appointment with their primary care provider or with a higher echelon of care such as an emergency room or urgent care. Furthermore, it is relevant to acknowledge that those patients who have a history of prior head injury, anxiety, and/or depression may need closer follow-up and most-likely referral for specialized care as these disorders can complicate symptom resolution. This project also did not evaluate patient satisfaction regarding the implementation of telemedicine as a substitute (when applicable) for face-to-face appointments. This would be an interesting point to evaluate further.

Another systematic limitation existed during the implementation phase of this project. Data regarding initial assessment and symptom severity scores in the pre-intervention group utilized the Sport Concussion Assessment Tool-3 (SCAT-3) and its corresponding 22-point symptom severity scale. In order to use the most up-to-date assessment tool, the post-intervention group utilized the SCAT-5 assessment tool and corresponding 22-point symptom severity scale. Although both scales evaluated 22 symptoms on a scale of zero to six, all of the symptoms were not the same, however they were closely related. There were five discrepancies. The SCAT-3 symptoms scale evaluated nausea and vomiting separately. It also evaluated numbness, tingling, and depression. The SCAT-5 symptom scale assessed nausea and vomiting

as a single symptom. The symptoms of “more emotional”, “pressure in head”, and “don’t feel right” were also different when compared to the SCAT-3 scale. This could perhaps explain the large difference in symptom severity scores for the initial and face-to-face F/U scores between the pre and post-intervention groups.

### **Conclusion**

Timely assessment, diagnosis, and treatment of concussions is imperative to prevent the detrimental sequelae and complications that can occur. The implementation of this evidence-based project met the intended purpose. As with any study or project implementation, multiple limitations were acknowledged. However, the expected result of this project was consistent with the research and evidence that was applied to implement the change. The utilization of evidence-based interventions, clinical protocols and telemedicine, can improve clinic efficiency and concussions outcomes without causing a detrimental effect on patient outcomes.

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