Drug Therapy Problems in NCAA Division I-A Minnesota Gopher Student-Athletes

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ABSTRACT

As with all competitive sports, in NCAA Division I-A athletics it is important to maximize controllable factors in order for each athlete to compete at his or her best. One important and controllable factor that has the potential for improvement is the athlete's medication experience. When medications are used to treat the correct condition, administered at the right time, and with the correct dose, they have the potential to improve outcomes and enhance athletic performance. As an example, it is essential that a soccer player who has asthma is using the correct inhaler, at the correct time, with proper technique, and with the correct number of puffs in order to support breathing and improve oxygen transportation during a game. Ineffective and unsafe use of medications can lead to serious disease-related events and also prevent an athlete from achieving their performance goals when they are not being used correctly. The goal of this project was to explore the presence and extent of drug therapy problems (DTPs) among a college athlete population. Within the 10 student-athletes who were interviewed, there were a total of 36 drug therapy problems identified, many of which were tied to a lack of understanding for their own medication regimen. This project suggests that medication-related needs may not be appropriately addressed among the college athlete population. The addition of a pharmacist on the athletic healthcare team would ensure appropriate medication use and optimization for health outcomes and overall athletic performance.

Key Words: Athlete, Medication Therapy Management, Pharmacist, Student health services, Sports medicine

INTRODUCTION

Medication use and experience in NCAA athletes is largely unexplored, primarily because this is a young, healthy population in excellent physical condition. However, young healthy athletes do have chronic and acute medical conditions that require medication use, including asthma, mental health, reproductive health, pain management and dietary supplement use.[1-5]

In NCAA Division I-A athletics, it is important to maximize controllable factors in order for each athlete to compete at his or her best. One important and controllable factor that has the potential for improvement is the athlete's medication experience. Medication experience is defined as, 'the sum of all the events a patient has in their lifetime that involve drug therapy.'[6] This is an individual's personal experiences with medications that shapes attitudes, beliefs, and preferences about drug therapy. In addition to overall health needs, college athletes have an additional focus on sports performance. Colleges and Universities devote resources to care for the unique physical needs of athletes by hiring athletic trainers, dieticians, and other professionals, but the chronic and acute medication needs of college athletes is not specifically addressed. Although strategies for pharmacists to become involved in university-based sports programs has been proposed previously, an understanding of the nature and type of drug therapy problems experienced by student-athletes has not been well studied.[7]

The goal of this project was to explore the presence and extent of drug therapy problems (DTPs) among an NCAA Division I-A student-athlete population.

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METHODS

Patient Selection

Target participants in this exploratory pilot study were current NCAA Division I-A University of Minnesota Gopher student-athletes. Student-athletes with self-reported mental health issues were excluded from this study. This analysis was reviewed by the University of Minnesota Human Subjects Protection Program as an Exempt, Category 4 study (IRB Study No. 1607E90961). A convenience sample of student-athletes was used in this study based on referrals and individuals known to the researcher.

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Data Collection

The researcher met with each student-athlete one-on-one in a private area of a public setting for 45-60 minutes to collect the student-athlete's current medication list including prescriptions, over-the-counter medicines, supplements, vitamins, and herbs, as well as to conduct a verbal review of systems. An individualized assessment was conducted, and a medication treatment care plan was created in consultation with a clinical faculty practitioner, and then provided to the student-athlete to address each drug therapy problem identified during the assessment. The qualitative data was collected via a reflection log during the medication review sessions with each athlete from which the researcher and clinical faculty practitioner coded using an induction process for emerging themes.[8]

The exploration of drug therapy problems in this convenience sample of student-athletes provides an opportunity to use qualitative research methods for identifying common themes. A general inductive approach for qualitative data analysis provides a framework for condensing raw text data into a brief summary format, and to help establish links between objectives and findings in the development of a model or theory about the underlying structure of experiences.[8] This general inductive approach provides a convenient way of analyzing data in comparison to other qualitative analytical methods derived from a grounded theory approach. This general inductive qualitative analysis approach may therefore be ideal for an exploratory study of drug therapy problems in student-athletes in the context of nascent roles for pharmacists on student-athletes' healthcare teams.

Criteria for Drug Therapy Problem(s)

A DTP is any undesirable event experienced by a patient that involves drug therapy and that interferes with achieving desired goals of therapy.[6] DTPs were classified according to four categories: indication, effectiveness, safety or convenience. These four categories are further characterized into subcategories. Indication was subcategorized as "needs additional drug therapy" and "unnecessary drug therapy." Effectiveness was subcategorized as "dose too low," "more effective drug available" and "needs additional monitoring." Safety was subcategorized as "adverse drug reaction" and "dose too high." Convenience was subcategorized as "nonadherence/noncompliance."[6] For DTPs related to the use of non-pharmacologic therapies, subcategory classification was based on the student-athlete's intended goal to eliminate the need for or to improve the effectiveness of drug therapy. Finally, some DTPs could be categorized in more than one way, and for these cases, the hierarchical DTP categorization was used (indication being assessed first, then effectiveness, followed by safety and finally convenience).

RESULTS

The study included females (8) and males (2) participating in football (1), gymnastics (1), soccer (3), and track & field (5). All of these student-athletes were between 19 and 21 years old. After assessing each student-athlete's medical and medication needs, and conducting a verbal review of systems, a variety of drug therapy problems were identified for each student-athlete.

There were a total of 36 DTPs identified across all the student-athletes (see Table 1). The most frequently identified DTPs were related to indication, followed by effectiveness and then safety. The medications associated with each DTP category are presented in Table 2.

TABLE 1: Drug Therapy Problems Across 10 Student-Athletes
Indication (18)
• Needs Additional Drug Therapy (15)
• Unnecessary Drug Therapy (3)
Effectiveness (9)
• Dose Too Low (1)
• More Effective Drug Available (4)
• Needs Additional Monitoring (4)
Safety (4)
• Adverse Drug Reaction (2)
• Dose Too High (2)
Convenience (5)
• Nonadherence/Noncompliance (5)
Total Number of DTPs (36)

TABLE 2: Medications Associated with Each Drug Therapy Category (frequency)
Indication
• acetaminophen (1)
• AdvoCare Catalyst ® (amino acid supplement) (1)
• calcium supplement (1)
• corticosteroid (1)
• electrolyte therapy (1)
• ibuprofen (2)
• influenza vaccination (9)
• magnesium (1)
• vitamin D3 supplement (1)
Effectiveness
• acetaminophen (2)
• ferrous sulfate (2)
• ibuprofen (1)
• melatonin (1)
• meloxicam (1)
• Tri-Lo-Sprintec ® (ethinyl estradiol/norgestimate) (1)
• vitamin D3 supplement (1)
Safety
• ibuprofen (3)
• vitamin D3 supplement (1)
Convenience
• Advair ® (fluticasone propionate/salmeterol 250/50 mg) (1)
• iron supplement (2)
• vitamin D3 (1)
• Monessa® (ethinyl estradiol/norgestimate) (1)

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In addition to tallying the number and type of DTPs identified for each individual athlete, narrative data collected during the medication review session was coded using an inductive process by the one researcher (BM) and the faculty clinician preceptor (BI). Two themes emerged: student-athletes require additional education related to medication use as lack of understanding leads to inappropriate use and poor outcomes, and lack of qualified professionals involved in the student-athletes' medication and supplement use.

Theme 1: Student-athletes require additional education related to medication use as lack of understanding leads to inappropriate use and poor outcomes. Examples illustrating this include inappropriate use of asthma inhalers, pain management, treatment of low ferritin and vitamin D levels, and hydration strategies.

Examples:
All of the athletes with asthma reported their asthma was not well controlled. Further, they reported they were not using their controller inhalers because it did not "feel like it was working." Asthma controller inhalers typically include inhaled corticosteroids and are to be taken regularly to control chronic symptoms and prevent asthma attacks.[9] In this project, these athletes with asthma all happened to be soccer players. According to Runner's World, the average soccer player runs about 7 miles in a 90-minute game.[10] It is well known that allergens, exercise, and extreme temperatures can induce asthma exacerbations, all of which the soccer athletes are exposed to during any given season. The inappropriate use of the controller inhalers led to poor asthma control and likely prevented these athletes from achieving optimal performance. The student-athletes did not understand that the purpose of the control inhaler was to prevent exacerbations rather than to treat them.

Pain management described by the athletes interviewed is another area where lack of understanding led to inappropriate use and poor outcomes. One athlete reported that he took ibuprofen prior to each track meet and when asked why, he stated he was "not sure, it is just out of habit." A number of the student-athletes used acetaminophen and ibuprofen interchangeably and did not understand when to use one over the other. This was evident in that several of the student-athletes reported acetaminophen to be ineffective for their inflammation related injuries.

Another example tied to pain management was revealed with an athlete who was taking eight 200-mg tablets of ibuprofen prior to each soccer game. Because ibuprofen is available over-the-counter without a prescription, it may not be viewed as a dangerous medication even though overuse can lead to complications including kidney damage that can be exacerbated when dehydrated, an important consideration in sports that involve intense exertion over a long period of time such as soccer. Ibuprofen was not effectively managing the athlete's pain and required alternatives. Overuse and misuse of pain medications have potential serious outcomes and do not lead to optimal clinical response or athletic performance.

A final example of how lack of understanding leads to poor outcomes was the use of iron supplementation to treat low ferritin levels (see Table 2). Several females were instructed to be on iron therapy because they tested low for ferritin. Serum ferritin is an important blood test to help distinguish between iron deficiency anemia and other anemias of chronic disease.[11] It is routine to obtain baseline iron levels including ferritin for incoming female student-athletes at the University of Minnesota. The majority of female student-athletes interviewed were not taking their iron supplement for a variety of reasons ranging from a lack of understanding, to side effects, to difficulty opening the individually packaged tablets. Two student-athletes were under the impression that their iron supplement could not be taken in concurrence with their vitamin D supplement. The vitamin D did not contain calcium or any other component that would interact with, or bind to, the iron supplement. This misunderstanding resulted in adherence difficulties that were not necessary. The athletes could remember to take one supplement or the other, but not both the iron and vitamin D at different times of the day. One student-athlete reported that the last time she was educated on her vitamin D and iron supplement was a year and a half prior to our meeting. While education is happening for the student-athletes, it does not appear to be sufficient.

Theme 2: Lack of qualified professionals involved in the medication and supplement use.

Examples:
Continuing with the qualitative analysis theme of iron supplement therapy to treat low ferritin levels, a soccer player reported during the medication therapy management session that a number of her teammates, including herself, tested low for ferritin and were instructed to supplement with iron therapy. When asked the reason for not taking the iron as directed, she reported that the individually packaged iron supplements were too difficult to open and several of the athletes decided not to take the supplement altogether. Student-athletes reported that their healthcare team was unaware of this barrier and had stopped testing, treating and monitoring serum ferritin as it seemed to be a waste of money. A track athlete reported she discontinued the iron therapy on her own because of stomach upset. Uncovering these simple barriers and addressing them could make a difference in overall health especially in these sports where student-athletes are expected to run, sprint, and be explosive and dynamic for an extended period of time; 90 plus minutes in the case of soccer.

Because there was not a member of the athletes' healthcare team specifically focused on medication use (prescription and non-prescription), there was a lack of awareness and follow-

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up with this therapeutic intervention. Several track athletes reported they had baseline ferritin levels measured but did not recall that there was follow-up or a discussion of how the iron therapy was working. Follow-up is key to know if a medication is safe and effective and to determine if the drug therapy should be increased, decreased or maybe even discontinued. This lack of follow-up was also seen with a football player who found out his vitamin D levels were low only after he broke his leg. He was initiated on corrective dose vitamin D therapy, which is usually prescribed for 8 weeks and then new levels are drawn, and in this case, vitamin D supplementation had been continued for 4 years without having his levels reassessed.

Another example demonstrating where there was a lack of qualified professionals involved was with influenza immunization (e.g. "flu shot"). The flu shot may help prevent or at least shorten the duration of the flu as well as protect against its complications and spreading the virus to others; all of which are important for student-athletes to be able to train and compete at their best.[12] Only one of the student-athletes interviewed for this study reported to have received the influenza immunization and for most, the reason for not receiving the vaccination was tied to misconceptions about perceived risks and benefits of immunization.

DISCUSSION

The goal of this project was to explore the presence and extent of DTPs among a college student-athlete population. Within the 10 student-athletes who were interviewed, there were a total of 36 DTPs identified, many of which were tied to a lack of understanding of their medication regimen. This project suggests medication-related needs were not being appropriately addressed among the college athlete population.

The medication-related needs identified in this project are supported by other reports in the literature regarding a young, college-aged population. According to a survey done by the American College Health Association in 2012, 9.4% of college students report having asthma.[13] Another study looking at a variety of college institutions in Texas found that only 4 of the 17 institutions had individualized asthma action plans in place for their students.[14] One study looked at the prevalence of asthma in NCAA Division I-A athletes at Ohio State University to find that it was nearly double that of the general population 18-24 years of age.[1] According to a systematic review of inhaler technique for MDIs (metered-dose inhaler) and DPIs (dry powder inhaler), only 31% of people use the correct technique.[15] The prevalence of asthma in college-aged individuals, including the student-athletes in this analysis, coupled with incorrect inhaler technique suggests pharmacists can have a role and an impact on achieving asthma treatment goals and resolving DTPs in college-aged individuals with asthma.

The risks of unsupervised medication use are known among the athlete population and there is warning in the *2013-2014 Sports Medicine Handbook*, "prescription medications have been provided to student-athletes by individuals other than people legally authorized to dispense such medications," which has the potential to lead to serious medical and legal consequences.[16]

Making health decisions without the input of qualified health professionals is also a known issue, but among athletes, the interest in dietary supplements for potential performance advantages is especially common. Athletes and others may not view supplements as medication or assume 'natural' products do not carry risks. Supplements contain ingredients that have the potential to interact with other medications, conditions, and one's physiology. Competitive athletes, such as NCAA Division I-A student-athletes, are frequently looking for nutritional strategies to "support training and recovery efforts that may ultimately maximize athletes' performance."[17] Some of the supplements these Minnesota Gopher student-athletes use includes: beet juice to help control asthma during soccer games, NO-xplode ® to enhance benefits of weight training, fish oil for heart health, AdvoCare Catalyst ® capsules to increase muscle tone and cut weight, AdvoCare Muscle Strength ® to improve muscle strength, O_2 Gold ® caplets to maximize use of lungs and workout, and Vega Sport Protein ® to improve muscle recovery. A majority of NCAA Division I-A student-athletes obtained information regarding supplements from family, friends, strength coaches, athletic trainers, coaches or registered dieticians, whereas less than 10% reported using a pharmacist.[18] In addition, 17-34% of collegiate athletes want to use supplements to treat sports-related injuries and would benefit from "scientifically sound guidance."[18] A survey revealed that 89% of the college athletes have or were currently using nutritional supplements including energy drinks (73%), calorie replacement products (61.4%), multivitamin (47.3%), creatine (37.2%) and vitamin C (32.4%).[19] The NCAA recognizes supplement use is prevalent among its athletes and it can be dangerous to their health in recommending they consult the sports medicine staff prior to initiating any supplement;[16] currently, that staff does not include pharmacists.

NCAA sports programs spend large amounts of money to ensure athletes are healthy and performing at the top of their abilities. One source reports the median dollar amount spent per NCAA Division I athlete is $96,000 compared to the median dollar amount spent per full-time student that was less than $14,000.[20] Rarely does a student-athlete's healthcare team include a pharmacist. Yet, pharmacists are uniquely qualified to address the medication issues common among college-aged students and are in a position to ensure the other training team efforts are optimized. Although ways for pharmacists to become involved in university-based sports programs has been proposed previously, this study contributes to an understanding of the nature and type of DTPs experienced by

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student-athletes.[7] This small cohort of NCAA athletes identified ways team training resources were being wasted; adding a pharmacist to the athletic training team is a wise strategic move and may prove to be a sound economic decision.

While not addressed in this project, medication management tied to mental health illnesses is often patient-specific and requires fine-tuning to get the desired effect without undesirable side effects. Mental health needs among college students have received a lot of attention lately. According to the National Alliance on Mental Illness (NAMI), 25% of college students ages 18-24 have a diagnosable mental illness.[21] Further, according to a survey by the University of Michigan School of Public Health, 33% of all college students experience significant symptoms of depression, anxiety or other mental health conditions. Of those college students surveyed only 10% of student-athletes seek help compared to 30% of non-athletes.[2] Again, adding a pharmacist to the athletic training team would be an effective way to addressing this known health concern among college students.

The business case for pharmacist integration on healthcare teams continues to strengthen. The healthcare teams of student-athletes typically consist of team physicians and athletic trainers, and the business case for pharmacist integration on a student-athletes healthcare team warrants further study and research. Embedding pharmacists in clinical practice has been shown to improve clinical, economic and humanistic outcomes, and is being encouraged by the American Medical Association.[22,23] One obstacle to pharmacist integration relates to an exclusion from the Social Security Act Amendments of 1965 such that pharmacists have not been authorized to bill Medicare directly for patient care services. Fortunately, there is currently a shift taking place to move healthcare reimbursement away from fee-for-service financing to value-based payments based on keeping patients healthy and out of the hospital and emergency room settings. Therefore, pharmacists' contributions to improving patient outcomes in team-based care will take on greater importance as financing continues to migrate toward value-based payments.

It is evident NCAA Division I-A student-athletes are experiencing DTPs. Additionally, further research is needed to add to DTP knowledge and awareness for these student-athletes. Pharmacists have a critical role to play in understanding the student-athletes' medication experience in order to maximize their medication therapies and ultimately their athletic performance. Pharmacists would be a valuable asset to the healthcare team for this population.

According to an athletic trainer at the University of Minnesota, student-athletes are educated on their medications including asthma medications. This athletic trainer reports attending primary care provider appointments with the student-athletes on occasion to help reinforce key educational points, however, given the results of this study, it is evident more can be done. This is where a pharmacist can step in. Part of a pharmacist's role is teacher and they can leverage that role to ensure student-athletes understand their medications through a variety of techniques, including teach-back, visual displays, demonstrations and more to improve medication effectiveness through an improved understanding of the indication, effectiveness, and safety of their medications.

A prescriber's area of expertise is a clinical diagnosis. An athletic trainer's expertise is to provide emergency care, support clinical diagnosis in partnership with the prescriber, and injury recovery/rehabilitation. A pharmacist's expertise is in the effective and safe use of appropriately indicated medications. We can all work together using our strengths to benefit student-athletes and enhance their athletic experience.

By adding a pharmacist to the healthcare team for student-athletes, both clinical and athletic goals will be met. When clinical goals are met so too are athletic goals; several examples are outlined below. Well-controlled asthma optimizes oxygen exchange, which is essential to muscle performance. Similarly, ferritin levels within an acceptable range result in ideal oxygen delivery allowing an athlete to utilize muscles for the explosiveness or endurance necessary to compete at a high level. Adequate and safe pain allows for an athlete to train and prepare as well as perform during competition. Receiving an annual flu shot greatly reduces the risk for influenza and at the very least reduces the severity and length of the infection preventing an athlete from missing essential training sessions as well as competition. Finally, competing at a high level requires a great deal of mental toughness, which is near impossible to achieve when battling a mental health issue. NCAA sports teams are already investing extensively in athletic training teams, but missing major ways to optimize medication-related goals; student-athletes need and deserve a pharmacist on their athletic training teams for both clinical and athletic reasons.

Limitations

One of the limitations of this study is that a follow-up assessment of progress toward goals of therapy and resolution of DTPs was not conducted. Pursuant to the IRB-reviewed study protocol, the student-researcher did not have access to participants' medical records or laboratory testing results. It is possible access to participants' medical records may have revealed that some DTPs had already been addressed. It is also plausible that access to medical records could have resulted in the identification of additional DTPs. As mentioned above, the goal of this study was to explore whether or not Division I-A student-athletes are experiencing DTPs, not to actually follow-up over an extended time to ensure the resolution of these DTPs. While each athlete was given an individualized plan, it is

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not known for each athlete if the plan was actually implemented or shared with the student-athletes' care team.

Another limitation of this study is that the researcher is a student-pharmacist and it is possible more DTPs could be uncovered with more training and experience. Moreover, it is noted that student-athletes with known mental health issues were excluded. Medications used to treat mental health conditions such as anxiety or depression often present the greatest risk for drug-supplement interactions. Athletes are shown to present with symptoms of depression (21% of a sample of 257 collegiate student-athletes in one study experienced symptoms of depression), anxiety, eating disorders and more.[24]

Use of the guiding framework for conducting the inductive thematic analysis in this study also has limitations. The qualitative analysis approach advanced by Pope and colleagues is particularly useful in research that produces large amounts of textual information such as that from transcripts and observational field notes.[8] Textual data are then explored inductively using content analysis to generate categories and explanations often with the assistance of computer software programs. This study employed interviews from 10 student-athletes in which themes readily emerged in analyzing recurring and common DTPs identified in these individuals.

CONCLUSION

This project suggests medication-related needs are not being appropriately addressed among the college athlete population. The addition of a pharmacist on the athletic healthcare team would ensure appropriate medication use and optimization for health outcomes and overall athletic performance.

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