

“Performance Enhancing Drugs in Endurance Sport can Effect an Athlete’s Ethical Decision Making and Consequently Fair Play in Sport”

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SECTION ONE

Introduction

The purpose of this thesis is used to identify the key significance of Performance Enhancing Drugs (PEDS) as they relate to endurance sports. To achieve this, this paper will concentrate on Lance Armstrong and the US Postal Service Cycling Team and will focus PEDS, in specifically on Erythropoietin (EPO) and blood doping in endurance sports. It is important to analyze an athlete's ethical decision-making skills and see what factors influence an athlete to take PEDS. There is evolving technology and medicine that constantly comes out. Society needs forward thinking for what the next generation of PEDS will have to offer.

What are PEDS

Performance Enhancing Drugs (PEDS) are substances that are used to alter the physiological and biological function of the human body which consequently allows an athlete to perform more efficiently (3). There are many types of PEDS that athletes can use and are effective in altering the human body to enhance performance. When these methods or substances are used, it puts into question the ethics of the athlete and the sport. To this day there are hundreds of prohibited substances and methods that athletes are not allowed to use, most of which are prohibited at all times. Some of the most well-known and common PEDS used in sport include anabolic steroids, Human Growth Hormone (HGH), Erythropoietin (EPO) and blood doping. Based on the literature, all prohibited PEDS have an effect on the athlete's body, their performance and have negative health consequences. I have chosen to home in on these four PEDS as they are quite commonly abused in endurance sport. These four PEDS also seem to be more potent than others which is why athletes in the endurance world are more apt to abuse them.

Types of PEDS

Anabolic steroids are a synthetic variation of the male hormone, testosterone. Athletes may abuse anabolic steroids to gain increased muscle mass. With use of anabolic steroids, there is an increased risk of developing kidney and liver problems and an increased risk of blood clots.

HGH can be commonly seen in both anaerobic and aerobic sports since it can be used to increase speed, strength, and recovery process (9). HGH can produce the side effect of an individual becoming insulin resistant. There may also be a linkage to an increased risk of cancer due to elevated cell division that occurs when consuming an excess amount of growth hormone.

Although anabolic steroids and HGH are both commonly used in anaerobic sport they are important to consider since any athlete could still participate in the consumption of them.

Athletes in aerobic sport may want to consume such drugs to increase their muscle mass and strength to help with competition.

EPO is a naturally occurring hormone produced by the kidney and liver that stimulates bone marrow to increase Red Blood Cell (RBC) production. It can be made synthetically to increase the amount of red blood cells in the body, so there is more oxygen available to be delivered to working muscles. Intaking EPO when unnecessary can lead to blood clots, heart attack and/or stroke (6).

Blood doping is a method of altering the blood or taking substances that are used to increase the number of RBCs in the body. It is most commonly seen in three manners. The first would be with the use of an enhancement synthetic drug, such as EPO which increases the RBC volume. The second would involve an athlete removing their own blood when performance doesn't matter, storing it, then reinjecting when they want to accelerate their performance. This will

increase both blood volume and RBC volume. The third would be to use transfusions of someone else's blood, which is uncommon, but can occur. This too would increase blood volume and RBC volume but avoids the need for the athlete to remove their own blood. However, it does increase the complexity and need for a "donor". Athletes have been known to use all three methods singularly or combining them together (6).

Blood Doping Physiology

Red blood cells (RBCs), also known as erythrocytes, make up for one third of the human body's cells. Since RBCs lack the most common organelles such as a nucleus, mitochondria, and ribosomes, it is hard for them to repair themselves when damaged. Their lifespan is short, averaging 120 days, so the human body is constantly trying to make more. The most important component of an RBC is Hemoglobin (Hb) content since it makes up 95 percent of its protein structure. Hb is a protein in which its quaternary structure allows for transport of oxygen and carbon dioxide throughout the body. One Hb molecule is made of four globular protein subunits, where each subunit can hold one heme, making four heme sites in full. Iron ions found on heme molecules allow for the binding of oxygen. Since the iron ion and O₂ have a weak interaction, O₂ is easily delivered to working muscles and tissues. Hb will continuously gain O₂ until a heme molecule is full (15).

Since RBCs are not able to repair themselves, new ones must be created through a process called erythropoiesis. This process occurs in red bone marrow found in the body such as the vertebra and proximal limb bones. In order for red bone marrow to complete this process, it is important that certain nutrients are obtained such as amino acids, iron, B12, B6 and folic acid. Without these key nutrients, dangerous conditions can occur such as anemia (15). Erythropoiesis is stimulated directly by EPO, released from the kidneys and can be considered recombinant (1).

The body can naturally release EPO for reasons including a decreased blood flow to the kidney, decreased O₂ concentration in the lungs, or because of damage found on the lung's respiratory surfaces (15). Reasons for recombinant human EPO (rHuEPO) to be used is based upon symptoms of anemia in patients that may have cancer or chronic kidney diseases (1). Those in the athletic world had discovered that EPO can increase their oxygen utilization and began to abuse the drug in hopes of accelerating their performance through misuse.

In relation to the physiology of EPO, blood doping could be a process used to further increase the number of RBCs circulating in one's blood stream. With the addition of extra RBCs, there are more heme sites for O₂ to bind, leading to an abundance of O₂ being delivered to the muscles (6). An increased amount of EPO in the system can help by having the effects of stimulating cell division of erythroblast stem cells and speeding up the maturation process of RBCs (15).

Risks associated with blood doping

It is extremely risky to participate in blood doping of any kind. With repeated transfusions, one runs the risk of contaminated blood or bacterial infections. The athlete also runs the risk of trusting that whoever is doing the transfusion is running a sterile field. When doping through the use of EPO it would be extremely risky because it is easy for one's EPO levels too high in the body.

When EPO levels become too high in the body, the blood begins to thicken. Viscous blood is not good for the body because it means the heart is going to have to work harder in order to pump blood throughout the body. This can lead to an increased risk of heart attack or stroke (6).

Injecting a synthetic EPO in one's system, does also not allow the body to naturally produce the right amount on its own. This can deceive the body into thinking it does not need to produce EPO on its own because it's intaking these extra amounts. When an athlete then stops using this PED, it is very likely that it's body will be confused on why there is no more EPO entering the system anymore.

Blood doping in sport

PEDS can be enticing to athletes of various ages, sports, and training history. Even if an athlete is successful in their training and competition, the desire to take PEDS can still linger. Athletes may engage in PEDS because of their constant want to improve their performance in order to thrive in their sport.

Blood doping is most commonly seen in the world of endurance sports. Those who participate in large volumes of aerobic activity (20+ hours/week), know that it is crucial to have oxygen pumping to muscles that you are using for an extended period of time. Competition in endurance sports can vary from 60 minutes to five hours in length. These sports can be seen as more challenging than others because of the amount of distance and time it takes for an athlete to compete and/or train.

Cycling is a popular endurance-based sport which consists of an athlete riding on a bike for many miles through flat and mountainous terrain. Training for a professional cyclists can include daily rides from 90 minutes to five hours, and in total, it is typical for the athlete to train 20-30 hours per week. Professional cycling can be seen as extremely difficult for several reasons. One of them being the athlete has to generate as much power from their legs as possible. It is also important for the athlete to train outside to get used to different head or cross winds that can

occur during the competition period. It is also important for the cyclist to know when to switch gears. Since it is an endurance-based sport, the competition length period could be anywhere from 5-6 hours and the athlete can burn upward to 7000 kilocalories a day. It is extremely important for cyclists to have a well-planned course of action, so they are prepared for competition.

As soon as EPO was discovered, athletes in the endurance world, especially cycling, started to utilize this drug in their training regimen. It is now unveiled that cyclists were using PEDS years before people knew they were in use. It began with the use of stimulants such as coffee and amphetamine, which was to help reduce fatigue. It then switched to EPO when athletes discovered its notable effect on enhancing oxygen utilization.

EPO has now become to be known as a “game changer” in endurance sports, specifically cycling. The aerobic work that is involved in the sport is extremely intense based on the time, distance, and complexity. Along with an athlete’s training regimen, EPO has the power to give the athlete the extra push they may need to perform better in competition and succeed. Their working muscles, predominantly in the legs can utilize more oxygen from the EPO intake, which can give them a leg up on their opponent. For professional athletes, it is reported that EPO can improve your overall performance by five percent which can be the difference between winning and being minutes behind the leader (10).

It is important for athletes to remember that EPO, as well as other PEDS were developed as synthetic drugs to help individuals struggling with terminal or acute disease. It is in no way intended to be used to enhance performance. Athletes need to be cautious about what they are consuming and how it will affect their body.

SECTION TWO

History of PEDS

Wanting to improve performance through the use of drugs can be dated back to the ancient times when man first started physical competition. Organic doping, such as taking an excess of plants or certain parts of an animal's meat to increase performance has been around forever and eventually led to where we are now (16).

The first popular drug used in sport were anabolic steroids. These were used mostly by bodybuilders, specifically wrestlers when referring to Olympic sports. Testosterone is the most common form of an anabolic steroid and was synthesized in 1935. Its first use recorded was in the 1954 Olympics. More popular usage of this drug came in the 1980s (9). At this point, it was very common to see athletes abusing steroids, but scientists were still unsure on how to detect it. There were many accusations, but still no way to prove usage. Anabolic steroids were used not only used by bodybuilders and wrestlers, but athletes in endurance sports as well (10).

HGH was first created in the 1950s for young children and adults to use who may have growth or development issues. Athletes soon thereafter got their hands on it once they realized they could also use it to increase muscle mass. The most popular time of its use was in the 1980s.

EPO was first created to increase amount of RBC production in patients with anemia, dialysis, or cancer treatment therapies. These EPO treatments began in the 1980s and people were realizing that they were quite effective. The EPO gene was first cloned in 1985 and was from there on out utilized by athletes. It is estimated that at least 3-7% of elite endurance athletes were using in the 1990's (7). However, there were no reliable mechanism sources of testing for EPO until 1999 (16).

Governing Bodies created to deal with PEDS abuse

The International Olympic Committee (IOC) was originally created in 1894 to begin the foundation and regulations the Olympics we know today. Although it is still the same organization, the times have changed as well as a surplus of regulations and rules that the IOC puts out. Their mission is to, “build a better world through sport”. The Olympics is known to bring talent from all over the world to have a competition through summer and winter sports (11).

PEDS popularity in sport significantly increased in the 1980s, however, it is known that athletes were abusing before this time. The IOC first established the Medical Commission to fight doping in 1967. This was right in time to set up the first testing service for the 1968 Olympics. It was one of the first organizations, along with the Union Cycliste Internationale (UCI), to establish a committee to observe athlete’s health.

The Medical Commission, within the IOC, has determined medical codes which specifically states that doping is prohibited in Olympic sports. It also provides list of substances (ex. steroids) and various methods (ex. blood doping) that are banned to athletes. It is this committee’s obligations to make sure athletes stay clean during the games, as well as providing medical care if necessary.

After the 1980 Olympic Games, the commission was broadened into three categories: 1. Doping and Biochemistry of sport, 2. Biomechanics and Physiology of sport, and 3. Sports medicine and orthopedics. As the IOC was expanding their medical commission, it was in hopes to stop the progression of PEDS being used in sport. It was important for the IOC to try to implement restrictions to fight against doping, which was rising in popularity.

In the sub-commission, Doping and biochemistry of sport, it is their responsibility to maintain current scientific information concerning doping. It is in their procedures that laboratory equipment, testing procedures, and analyses should keep up with the introduction of new PEDS athletes may be consuming (14).

The UCI is a governing body for the sport of cycling. It was established in 1900 and used to help organize cycling competition's rules and establishments. The UCI anti-doping program began in 2013 and continues to work alongside WADA to govern a leading and productive program for athletes (1).

Governing Bodies Involvement

PEDS in sports didn't become a well-known topic until long after athletes were abusing.

Organizations that were created, were to try and help the situation in a reactive manner. Once they were created, more light was brought to the fact that athletes were using drugs to try to gain an advantage against their opponent.

Even though there was knowledge of synthetic EPO abuse, there was not much regulation. The IOC first prohibited the use in 1990 but there was no reliable testing's available (10, 11). Doping specifically did not become a big topic until the allegations that occurred in the 1998 Tour de France. At this time, the cyclists that had been racing in the Tour de France had been doping for quite some period of time, however this was not in the public eye and no one was convicted of cheating at this time. With the cases of doping scandals on the rise, came a new organization whose goal was to eliminate drugs in sports: World-Anti-Doping Agency (WADA). The IOC decided to act and helped to establish WADA in 1999, in hopes of combating PEDS. Within the first couple years of the IOC and WADA working together, the list of prohibited substances and

methods became stricter and began expanding. It was in hopes that with an independent agency that was combating doping, the problem would begin to resolve. Their goal was to help keep the world of athletics clean from PEDS.

WADA included representatives from the Olympic party and public authorities. To this day, it is more independent, but still has its own Olympic Committee to work with. Because of the doping allegations that rose in 1998 with the Tour de France, it was important for WADA to be created and work in contact with other organizations to help fight for athletic regulations in PEDS.

As of the Tokyo 2020 Olympics, the IOCs' Anti-Doping Rule Book defines doping as, "the occurrence of one or more of the anti-doping rule violations set forth in Article 2.1 through Article 2.10 of these Rules". Within these rules it is important to note that the athlete is not allowed to have the presence of a prohibited substance, its metabolites or markers in the samples that are provided. It is the athlete's personal duty and responsibility to know what substances and methods are prohibited in the games. If an athlete's sample A is positive and sample B is waved, the athlete is responsible for having PEDS in their system. The athlete is allowed to have an analysis of sample B. If this sample comes back positive, the athlete is confirmed to have PEDS in their system (11).

SECTION THREE

Ethical Decision-making

One of the most critical steps for an athlete to determine action of an ethical decision is to recognize that there is a moral problem existing in the first place. The athlete must use their cognitive processes to determine if a decision is ethically sound. This same rule will apply in an athlete's decision to engage in PEDS (5). In order to address ethical decision at hand, one may

consider Kohlberg's Theory of Moral Development. This theory can help to analyze steps in an athlete's decision-making process regarding PEDS.

The first stage of Kohlberg's Theory is the preconventional level. This is on the basis that once an individual knows a decision may be wrong, moral judgement is triggered. A person will assess their options and declare them as right or wrong based on their concern of being compliant to rules of authority or fear that punishment that may occur (5). In relation to an athlete considering the use of PEDS, the athlete will be conscious of what would happen if they were to get caught. Would they still have the opportunity to participate in their sport? If they are an elite athlete, could a governing body such as the IOC end their career based on a positive PEDS test? If it was only going to be a one game suspension instead of career-ending, would the athlete be more likely to involve themselves in PEDS? At the preconventional level, the athlete may also consider the ill effects that PEDS will have on their body. Are there studies that show the long-term effects of the drugs? Will the PED they have chosen to negatively alter their hormone levels? These are some of the questions the athlete may consider at this level when debating if they would like to involve themselves in PEDS.

The second stage of Kohlberg's theory is the conventional level. At this stage, an individual will question external factors that come into the decision-making process. They will consider if the people they consider closest to them would be okay with the decision that they are going to make (5). As human beings, it is important to us that we have the acceptance from loved ones in the decisions we make. Many people will consider the emotions and well-being of the ones we care about, which is why they can be such an influence on us. From an athlete's perspective, it may be worth their while to consider if their family, friends, and partners would be okay with them engaging in PEDS. Other people close to them such as their coaches and teammates may also

have influence on their decision. If the athlete believes that they would have support from these people, they will be more likely to participate in PEDS.

The third stage is the principled stage. An individual will think autonomously about a universal held principle (5). Will it be good for their own self-worth? Can it better the world in any way? An athlete at this level may consider if their engagement in PEDS would help align team cohesion. A rationale such as this may lead an athlete to engage in PEDS if the majority of their teammates are using as well. They may feel pressure to participate because if even one teammate is doing it, they may feel the need to keep moral high and engage as well. The athletes will determine if the morality of the decision will put themselves and others in a good moral standing.

Why an athlete uses PEDS

It is still hard to determine why an athlete may or may not chose to use prohibited substances. It is now clearly known that athletes should not consume PEDs to protect their health and preserve the nature of a fair play. Motives will vary based upon the athlete, the sport they play, which PED(S) they would consume, and what level of sport they are involved in (ex. high school vs. professional). Rationales regarding doping may include career goals, social norms of the sport and social influences of teammates, coaches, and physicians.

Career Goals

Once an athlete becomes professional in their sport, they will often make majority of their decisions based on their career goals. The same concept applies regarding their decisions of PEDS use. Athletes may choose to dope in the hopes of prolonging their athletic career. It is also seen that some older athletes may think that they can gain back their previous levels of

performance in order to continue their career (12). It is uncertain why an athlete may want to prolong their career, but one assumption could be due to their love for the sport. However, the monetary initiative of continuing at a professional level can't be discounted. The money an athlete can gain from their career may be the biggest influence on their decision regarding PEDS. Professional athletes have a strong determination to become successful and most obtain the knowledge that PEDS can help to boost their performance. Athletes may feel more significant influence to use PEDS as they become more successful in their sport because they are more concerned to the financial gains to be had.

Social Norms

An athlete's community is made up of their teammates, coaches, and physicians. All of these people have a large influence not only on an athlete's professional career, but the decisions they may make outside as well. As a professional athlete, it may be common that these are the only people you interact with for weeks or months at a time due to the rigors of training. An athlete trusts the people that make up their "inner circle", which is often times who they get their information from regarding PEDS.

Teammates

Teammates may be the biggest social influence on an athlete as they are spending the majority of their time with these people. They interact during practice and competition and most become friends who start to feel more like family members. Typically, athletes on a team will chose their close circle and spend significant time together even during off seasons. Since teammates build a strong bond, topics of life and sport will always be of their conversation. It is very common that

teammates will give each other advice on topics arising on their teams or in their sporting world. This can lead to life-altering decisions in an athlete's career.

In the case of PEDS, it is more common for an athlete to begin to dope if their teammates are doing it as well. One source found that 80% athletes who doped were influenced because one of their teammates or opponents were doping as well (5). Teammates may peer pressure one another to dope so the team can excel. If all the athletes on the team improve, it may be more likely for them to compete at higher levels and beat more advanced athletes. This peer pressure isn't necessarily straight forward or aggressive, it could also be the influence of just being in the same environment of other athletes who dope. Some athletes state that the pressure just from being in a room with one of your teammates who dopes in unbearable (12). Doping has a team cohesion component, which is why teammates are so influential on one another (2). It is very hard to control the thought of PEDS if teammates or training partners are constantly doing it around you.

Coaches

Coaches also have a large influence on the athlete's decision-making processes. Most of the time at a professional level, it is typical that the reputation of the coaching staff will play a large influence in the team that the athlete chooses to play for. At this point in their career, athletes are well aware that coaches will have a major influence on their skills in the sport, moral character, and support structure. Coaches will try to boost team moral, which can also have an influence on the athlete³.

One of the coach's main responsibilities is prepping the athlete for competition. It is their job to know the skills needed to become successful in a sport and display that to the athlete. The coach

should be able to help the athlete improve during training and competition seasons. It is important for a coach to give advice to athletes on ways to improve their training, both physically and mentally. The coach needs to have awareness on how their advice will affect an athlete.

In reference to PEDS, it is always important for the coach to steer the athlete away from anything that may harm their body. Which unfortunately is not always the case. Coaches should have background information in a training regimen for the sport, nutrition aspects and enhancers that could potentially be used for the sport. If a coach is not well equipped in one of these areas, they should get an additional member of the team who is. This ensures that the athletes on the team are healthy.

Hopefully coaches have the best interests of their athletes at heart. However, we know that is not always the case. At the professional level, coaches may persuade their athlete in one way or another based on how it could benefit them. In some cases, the coaches may know of the athlete's involvement in PEDS, but don't want to interfere, as it is leading to success for both of them (12). Some coaches may see their athletes as ways to boost team stats or make them more money. It can turn the relationship between the coach and the athlete into a selfish one.

Physicians

Team physicians are in charge in taking care of the athlete's health. Their primary job may be in relation to sporting injuries which often includes musculoskeletal care. However, it is also important for the physicians to take care of the athlete's overall well-being and make sure that their bodies can maintain peak performance.

With this responsibility, comes a role in management. Team physicians typically work alongside coaches to evaluate the needs of their athletes, as well as working one on one with the athlete. Physicians will probably have a similar outlook as the coach in that they want their athletic team to be the strongest that it can be, and just like athletes, physicians can face an ethical dilemma regarding PEDS.

Other Competitors

The sporting industry is constantly evolving with new ideas and ways to improve performance. Individuals involved in this industry will look at other developing sports or companies that have been successful at improving an athlete's performance.

Unfortunately, this could also be an added influence on an athlete's decision to partake in the use of PEDS. Athletes in different sports can compare the effects of certain PEDS if they know other athletes are using. For example, some athletes have described how they have struggled mentally with their performance skills, because of the need to keep up with opponents. This may lead the athlete to taking PEDS if they suspect their opponents are doing it as well (12).

Interaction between all parties

Different team atmospheres between the teammates, coaches and physicians can all influence the idea of PEDS. There are many influential factors on an athlete's life that can lead them to abusing drugs in order to enhance their athletic abilities. It is important for all parties involved to look at their own morals. All parties need to be well educated on the topic of PEDS not only the effects it can have on their career, but on their health as well. The majority of athletes do not view doping as cheating, so they are more likely to participate (12). Everyone involved in the

sport (athletes, teammates, coaches, physicians, etc.) need to have a better understanding of the information regarding doping and learn how to succeed a goal without taking PEDS (18).

SECTION FOUR

Why is the focus on cycling?

Cycling is a popular endurance-based sport which consists of the athlete riding many miles through flat and mountainous terrain. Cycling is both physically and mentally demanding which is why it is considered one of the sports with widespread doping issues (7). Because of the complexity that comes with the sport, athletes may engage in doping because of the extreme challenges they face. Many people see road cycling as an individual sport, when in reality it is a team sport. Only one athlete can win, but it is important to note that teams can be as large as 20 riders and they train together, have specific roles during races, and all work cohesively in an effort to bring their leader to the finish first. Because of this team component and the bond fortified among teammates, it is quite considerable that doping can become systemic throughout the entire team.

There are many races through the year, but the most well-known is the Tour de France. Male cyclists can compete in this race that is held annually in France. This race is known for its difficult terrain and long duration and the fact that it is 23 days long. Cyclists ride 21 stages and only have two days of rest. There have been many cases of doping during the Tour de France and many allegations have risen against Lance Armstrong and teammates during his “victories” that have now been expunged from the record book¹.

Lance Armstrong

Young Athlete

Lance Armstrong is of course most well-known for his seven consecutive Tour titles from 1999-2005. Armstrong began competing in sports, such as swimming, at a young age of 12. From there, he began his interest in triathlons at 16 years old. Even at this age, his parents and fellow teammates stated that Armstrong was an aggressive athlete who was always hungry for new competition. Teammates claim that even being on the same team as him, they could see his bully-like attitude. He would always try to push teammates and competitors in this light so he could feel that he had a “fair” competition against them. This attitude stayed with Armstrong and has evolved over his career (13).

After triathlons, Lance fell in love with the cycling aspect of the sport and decided to focus on that direction. Influence from his childhood played a role his cycling career. Lance came from a single mother home where he was always trying to prove something. He showed rapid success as a young athlete and soon was even beating professionals. This may be why Lance carried his competitive attitude through his career. Being successful at a young age made Lance realize how much power he could hold if he turned into an exceptional athlete. And it is probably why he so aggressively wanted to accelerate his training and push others to do the same. Lance continued with cycling by joining the Motorola professional cycling team in 1993. This was the start of his professional career, all the while PEDS, such as EPO were just coming to light. Little did anyone know that the two worlds would collide to change the game of cycling for years to come (13).

Motorola Years (92-96)

Lance’s attitude around winning and doping only elevated as he continued racing with the Motorola team through 1996. While on the team, Lance was winning stage races, but was still hungry to compete in the Tour de France to show his ability as a young athlete. He does not recall the first time he used PEDS but recalls it was around 1992. His use of PEDS continued

exponentially as his career furthered. During his time on Motorola, Lance became close with several teammates who had a big influence on his athlete career, the most significant being Frankie Andreu. When Frankie and Lance became teammates, doping was starting to become popular in cycling. Their relationship was a strong bond that had elicited trust not only on the game play, but in life as well (10, 13). They were the type of teammates who became more like family to each other. Frankie states that during his time on Motorola he felt that he had no choice but to dope. He knew it wasn't just his teammates doping, but other competitors were doing it as well. He states that the pressure to dope began between 1993-95. He felt the need to involve himself in PEDS because his own teammates and competitors were also using (21). There is a lot of outside pressure from teammates to participate in things, such as doping, that need to be considered in order to protect the health of an athlete.

As team Motorola was in the crux of their 1996 season, Lance was diagnosed with life-threatening testicular cancer that had spread throughout his body. At the young age of 25, Armstrong decided it was time to stop cycling and take control of the diagnosis he had just received. While getting treatments, Lance's competitive side still came out. He stated that "cancer was a competition to me" (13). He would picture his treatments as a game of life and death while checking his tumor markers and scans. His mindset was always in competition mode ready to beat whatever came his way. This continues to show that Lance always had an aggressive attitude towards winning and he would beat anything that came in his way for a chance to be victorious.

Many people question whether doping may have played a role in creating or accelerating his cancer. Lance stated in his documentary on ESPN, LANCE 30 for 30, that he's not sure if it caused or progressed the cancer, but he wouldn't say no. He stated that he took HGH in '96 so it

could be possible that it helped the cancer grow and spread (10). Lance should have concluded at this point that he should stop using PEDS. However, it seems that he always felt he had to dope along with training to be successful.

During his time fighting cancer, Frankie, and wife Betsy, would often go to visit Lance during his doctor's appointments or treatment. Their relationship with Lance began to change in 1996 when they had a visit with him. Betsy and Frankie have since testified against Lance and stated that during one of his doctor's visits, Lance openly admitted to the PEDS he had taken precancer during competition which included "EPO, cortisone, testosterone, HGH and steroids" (10). This shows the arrogance that Lance carried. Even after the news came out, and court cases started he would always claim he never used. He would use aggressive tones and slander against Frankie and Betsy at this time even though it has since come out that they were telling the truth.

At this same time, it is important to note that allegations of PEDS use in cycling in 1996 were relevant, yet there were no reliable tests to determine if an athlete was truly using (10). At this point, a lot more was happening in the cycling community that was hidden from public view. Since this occurrence, Betsy had tried to help Frankie stop his use of PEDS and leave the cycling community. However, since everything was still under wraps in the sport, a lot of cyclists felt that it was safe to continue with their doping use while racing, and Frankie fell in love and continued racing and using.

US Postal Team Years (98-05)

The US Postal Service Pro Cycling team consisted of incredible cyclists from various countries which existed from 1996 to 2004. The team started to become the most synchronized and popular when Lance Armstrong joined in 1998 following his cancer treatments. At this point,

Lance was the biggest named American rider, but he still had a lot to prove from his post cancer treatment. He was once a premier athlete, but once his cancer treatments were finished, people questioned his ability to get back to where he was previously. Lance decided immediately after his cancer treatments that he wanted to get back to cycling in efforts to dominant the sport. This may be the reason that Lance continued with his PEDS use following his cancer treatments.

Along with just beating cancer, he was signing with a new team and getting new teammates. Some of the closest to him became Frankie Andreu, Tyler Hamilton, Floyd Landis, and Jonathan Vaughters. The influence that these teammates had on each other was tremendous especially in terms of doping (13). Through Tyler Hamilton's book, *The Secret Race*, it tells stories of the many encounter's teammates had with each other and doping. It follows discussions and real-life stories into what it was like to be a cyclist who doped at this time. While on the Postal team, teammates knew when they would be tested. They would be able to use an intravenous bag of saline in order to bring down their hematocrit level so none of them would get caught. As teammates, they stuck through this together and would rely on each other to let them know when testing would be taking place (10).

Questions on Lance's athletic ability rose as he had just gone through chemo and therapy. To many of the team's surprises, he had worked his way back to being the strong cyclist he was, and then some. Along with bringing back his physical ability, he also brought back his competitive and cocky attitude. He would use vulgar comradery while riding with his teammates since he was still dominating the team, and they were the ones needing to play catch up. Hamilton states that the energy Lance would bring when entering a room was an uncalming feeling and he always wanted to keep people on their toes (10).

With Lance Armstrong being one of the most prominent cyclists during the late 90s and early 2000s, it was his major influence that led others on the team to indulge in PEDS. They may have done it without him, but he was always pushing his teammates to be better. And they knew why he was more athletic than them, so they knew what they had to do to satisfy Lance. His need to win is the reason he continued to use PEDS and encouraged others to do the same.

At the time of creation of the US Postal Service Team, doping was the hot topic in cycling and almost every team was participating. At the time, if you were not doping, then you probably weren't winning. The most common form of doping that the team used was injecting EPO into their blood stream¹. The team doctor would help athletes determine how much EPO they needed in their system in order to increase performance levels but not get caught. He would carefully study their body weight and hematocrit levels. There had been many instances on when athletes on the team were going to get caught. When cyclers on the US Postal team first began using EPO, they would store it in white bags in their fridges. Soon thereafter other teams and governing agencies started to catch onto what they were doing. They would then quickly switch methods of how they were going to keep EPO a secret. They then switched to using Coca-Cola cans to have a better disguise for the EPO use. At points where the team would have to travel, they would have to be extra cautious about bringing along PEDS, since anyone could step on their bus to search for it. At one point, the team faked a bus breakdown on the side of the road so athletes could lay down and get an IV of EPO before one of the Tour stage. US Postal riders were taking blood doping to an extreme to make sure that their riders were "prepared" for competition.

Lance and Ferrari

During Lance's time on both the Motorola and US Postal Service team, he had the opportunity to work with Michele Ferrari, an Italian doctor and cycling coach. Ferrari is most famously known for supplying EPO to athletes in white paper bags. When EPO first became popular, Lance was hearing rumors about Ferrari's ability to enhance cyclist's performance and began to work with him. Ferrari then became the team physician when the US Postal Service team began. He and Lance had an automatic connection that others on the team could tell right away that they were going to keep their relationship private (10). Lance stated he would do anything that Ferrari told him². This shows how much trust Lance put into other people and drugs to help with his success. If Ferrari had never told him to dope, would he? It's difficult to examine since there are so many factors involved. It shows that athletes put a lot of trust and expectations into those that are in charge of teams. Since Lance was so successful while working with Ferrari, he encouraged others on the team to do the same.

US Postal Team and Ferrari

Since Ferrari was the team physician, he did have the opportunity to work with all athletes on the team. His philosophy would be that each cyclist needed to pay close attention to their weights and hematocrit levels, which he would regularly monitor. Ferrari would be truthful if he did not like their number and would upright tell them to change their training regimen. This may be why him and Lance got along so well. There were both blunt with teammates and wanted the same end goal, for him to win the Tour de France. Hamilton stated that Ferrari was always yelling at him to lose more weight, but the science behind it actually worked. With Ferraris numbers of improvement, Hamilton was able to increase his performance by 10% (10). When an athlete recognizes that their training plan is working, they will of course be more likely to listen to the advice of trainers and physicians. In most cases, this will turn into a trusting relationship with

each other. And just as Lance had stated, he would do anything he told him to do in order to get his numbers to where they had to be. Athletes need to be aware of the ethical decisions that trainers and doctors are pushing on them. At the time, everyone knew that PEDS were illegal, and honestly not a lot of information was out yet in regard to EPO and its effects.

Armstrong was noticing his teammates improvement while working with Ferrari. He also began paying attention to their numbers and would push teammates, such as Hamilton to train with him. At first, Hamilton loved the experience that he could ride next to Lance and would take note of his athletic ability (10). With the continued growing relationship, there was more privacy between Lance, Ferrari, and teammates. However, they wouldn't get enough attention about the facts on EPO and would sometimes be left in the dark in regard to issues happening with governing bodies.

Lance and the Andreu's

Since Lance and Frankie's friendship and working together on both Motorola and the US Postal service team, there have since been many disagreements between the two which has left them on unpleasant terms. The athlete's began using blood doping as a means to enhance their performance around the same time. However, Andreu's guilt hit him earlier around 2000 when he was continuing to help Lance win Tour titles. Andreu seems to sincerely regret his decision to taking PEDS and continuing to do it for so long. Unlike Andreu, Armstrong continued to use and lie to the public about his PEDS use. Once Andreu and others admitted to doping and stating that Lance used as well, Lance would use slander these athletes saying that they were falsely accusing him doping.

It is important to see the impact of doping on multiple athletes. In Frankie's case, he did not want to be involved but felt that he had to in order to keep up with other athletes. He also wished that there were more regulations in place in order to protect the athlete's health and ethics of the sport.

Frankie's wife, Betsy Andreu, also showed her support of WADA's creation. When Frankie was doping, Betsy did not understand why since she knew his personality and moral judgement. Sometimes it is hard for an athlete to keep their head on straight when making decisions like this. Frankie had continuous pressure throughout his career to continue taking, even when the allegations started. Betsy also told her side of the story in relation to the US Postal Team and their doping usage to WADA. Betsy was one of the first to try and reveal the truth of the doping allegations against Lance, but most people did not want to listen or believe her. She understood Frankie still wanted to participate in cycling but knew it was wrong. When she would try to tell her side, Lance would quickly turn the story and deceive those who began to believe her. The world was still celebrating him for being one of the most falsely famed successful athletes.

SECTION FIVE

Maturation of an athlete

Maturity is assumed as we get older based on the life experiences and problems that we have encountered. This also holds true to professional athletes as they have developed into who they are today based on their experiences in sporting dilemmas. Athletes should always try to uphold what they would think is right in the decisions they are faced in sport. This should help prevent both the athlete and sport from becoming unethical and keeping the game fair.

Maturation of Lance

In relation to Lance Armstrong, it is critical to analyze how he handled his career in regard to doping. He represents one of the biggest doping scandal in the history of sport. When people hear his name, it is automatically linked to him cheating his way through seven Tour de France titles. His use of PEDS in cycling can relate to what other athletes in any sport may have encountered with their decision involving PEDS.

Through his cycling career, Armstrong's decisions have not necessarily shown that he has developed into a human with good moral grounds. An athlete, just like any human, is supposed to learn from their mistakes and apply these experiences to future problems. When allegations came out against Armstrong for his use of PEDS, he would always be aggressive towards whoever questioned his character or judgement about the situation.

Allegations against Lance using PEDS

Allegations against Lance began in the late 1990s. While other athletes were beginning to admit their doping use, Lance was always aggressively claiming that he was clean. It was unbelievable to the public at the time because Lance was winning races against athletes who were admitting to PEDS. How could it be possible for someone to triumph over someone who was taking PEDS?

Not only would Lance never admit to doping allegations, but he would accuse others of doping. In 2003 he had informed the UCI, Tour de France organizers and WADA that the Spanish riders were doping and had suspicious hemoglobin levels (10). At the time of this accusation, Lance had been participating in PEDS for a decade. The only attention that Lance wanted to obtain during his cycling career was success, and he didn't want anyone else to be in his spotlight.

While still competing in Tours, Lance had even gone after his former teammates, including Tyler Hamilton. Hamilton decided to leave the US Postal Team in 2001 and began racing with CSC, a

Russian team. At this time, Hamilton was called in by the UCI for allegations concerning PEDS. Hamilton later learned that Lance had called the UCI on him. Hamilton was confused and angered since Lance was not only supposed to be a teammate and friend, but he had been partaking and pressuring Hamilton to do the same (10).

It may be unclear as to why Lance would try to invade on someone else's affair when he had plenty of his own issues to deal with. During his childhood and adult athletic career, it seems as though Lance always felt like he had something to prove. It seems Lance felt if people weren't talking about him, he needed to do something so they would. I think he also enjoyed the fact that he was able to get away with so many allegations while other careers were ending over it. He just wanted to be known as the most successful cyclist.

Allegations continued, and eventually this led to organizations bringing Lance to trial. During trials, other athletes and people involved testified against Lance to prove that he was on PEDS during his time winning the Tour de France. Lance would make bold remarks stating that he never involved himself in PEDS and that everyone was lying who had testified against him (13).

Admitting to PEDS

This continued until 2013 Lance finally admitted to doping while winning the Tour de France seven times. He first admitted to using banned substances, including doping, on Oprah. His attitudes towards his doping shined through during this interview. When first starting the interview, Lance seems animated and kind of laughs at the fact that it is a long, complicated story that is finally coming to light. It doesn't seem like he's nervous to admit his PEDS use, but almost annoyed by it. He also implies that between surviving cancer, making a family work and wanting to make a comeback in cycling, he had to dope because he needed to win. Oprah then

asks him a series of questions. She first asks if it felt wrong at the time, which Lance replies back “no”. She then asks, “did you feel bad at the time?” where he replies “no, that was even scarier”. Oprah then asked if he ever felt like he was cheating and he stated, “no and that was the scariest” (17). Through the interview it seems that a toll was taken on Lance from all of the lies and deceit that he had maintained through the last decade. There was too much pressure on him to keep all of his lies straight and it was time for him to come clean.

Even though Lance had now admitted to PEDS, he did not seem remorseful of his actions, especially in regard to how it made other people feel. He never apologized to all of the people he had hurt. People such as Tyler Hamilton and Betsy Andreu were just trying to tell the truth for their own freedom of not carrying around the lies anymore. Lance at the time was not letting this happen, and actually bullying people who were trying to stop his career because of his involvement and push for blood doping.

This shows that Lance never fully matured as an athlete until after his career was finished. One hopes that his doping career has taught him to not cheat and to admit to something when he is wrong. He should also take responsibility for his deceit against people who he claimed were close to him. If he had truly cared about them, he would not go after them in these ways.

SECTION SIX

The future of PEDS

It is essential to consider what advancements will be made in PEDS and how an athlete may use these to their advantage. There will always be advances in technology and medicine that can improve the human body and its functions. In history, it has been shown that athletes can abuse creative medicine techniques to improve their athletic performance.

Ethical questions involving PEDS have come into play: transgender athletes and designer babies. The participation of transgender athletes in sport have become more acceptable. But there is still a stigma on their involvement and the rules that should be in place to allow fair play.

Manipulation of genes has also been on the forefront of science with talk of people having the ability to genetically engineer their children. Designer babies may be happening today, but their effects need to be thought about for the future.

Transgender athlete history

Transgender athletes may have one of the biggest hurdles to overcome in sport. Yet for transgender athletes to be accepted in sport, there are more discussions and movements that need to take place. Being a transgender is defined as, “having a gender identity different from one’s sex assigned at birth, whereas sex is assigned by anatomy” (4). To help one become a transgender, there are medical treatments such as hormone therapy and sex reassignment surgery that one can go through to become the other gender (4).

In regard to transgender athletes, there is typically a bigger stigma involving transgender females than males in sport. Many people have a taken confused reaction to this, and don’t understand how this would be fair in sport. People get their information from this topic through the media which doesn’t normally give much clear information on the rules and regulations that have been set forth regarding transgender athlete’s participation in sport. It is important for society to be well educated on what this means when they hear a transgender athlete is involved in sport. It should be in the hands of the governing bodies, such as the IOC to clearly state the rules in the media and show support for those athletes who wish to participate fairly within the regulations that are put in place.

People may think that transgender females are trying to cheat or take advantage of the sport because of their desire to change gender. Many don't understand how it would be fair for a male to change their gender to female and be able to compete against women. Based on a typical body build of males, a lot of people don't see fairness in them competing in someone who is of smaller frame. Men are typically stronger than woman and contain more skeletal muscle mass in their body because of their testosterone levels. Even though women contain testosterone, it is a very small amount compared to men. Doctors have stated that a normal level of testosterone for males is between 9.2-31.8 nmol/L and for women is 0.3-2.4 nmol/L (3). However, it is important for people to realize the occurrences that take place when changing gender. Once they start their hormone replacement therapy, the body will begin to change into the gender role as female.

There have always been ways that athletes try to produce more testosterone in the body in hopes of gaining more muscle mass and increasing motivation for competition. The only natural way to increase testosterone levels is by making healthy lifestyle choices. This may include lifting weights, getting a good night's sleep and intaking enough protein. However, there are also synthetic ways to increase testosterone levels, which some athletes have been known to do. Whether testosterone are indicated and resulted from endogenous or exogenous variables, both can affect the athletic ability of a person (4).

Testosterone has been on the Prohibited List of WADA since 2011; it is classified under "Endogenous AAS when administered exogenously", since all of these substances are derived from testosterone. For athletes taking synthetic AAS, it is easier for tests to detect this form over the naturally occurring testosterone because their metabolites are not present (22). However, compared to other forms of PEDS, testosterone is relatively cheap and easy to find which is why more athletes may choose this over other forms.

However, for scientific test makers and those in charge of making guidelines for PEDS, it can become difficult to know the limit of how much testosterone should be allowed to be in an athlete's system. Naturally occurring testosterone can vary so much between people, even in the same gender category. It is important that even when these guidelines are in place, there are no false positive tests that are occurring.

This can be seen in the case of Caster Semenya in the 2009 800m Olympic race. Semenya was asked to undergo a gender verification test after detection of high amounts of testosterone in her body. Even though Semenya was not involved in any PEDS, she is intersex, which means she contains both female and male genitalia, which made her body produce higher levels of testosterone. They only wanted to let her continue in competition if she took suppressive testosterone medicine (4). At this point, it's a question of fairness on both parties. Is it unfair of regulators to say that she has to take this medicine because she was born with this anatomy? Is it unfair to her competitors because having this boost of testosterone may have helped her have a leg up on others? This is when the issues of genders and sport can come into play, which can be related back to transgender athletes.

The IOC has had the same set of guideline in place since 2015. These state that there are no restrictions for transgender males. In regard to transgender females, they have to have declared their gender for at least four years prior to the competition they want to compete in. They must have a testosterone level below 10nmol/L for at least 12 months prior to competition and must remain below this level during competition. They must also agree that they can get tested at any time during the competition period (11).

In more recent news, a scientific doctor for the IOC, Richard Budgett, stated that the IOC will have updated policies regarding transgender athletes after the Tokyo Olympics take place. The

IOC is waiting until after these Olympics for fairness of those who are prepared to participate under the current guidelines. He also described that he, as well as other members of the IOC have been in contact with athletes, doctors, and human right professionals to have as much input as possible on the corrective guideline (11).

Education regarding transgender guidelines

It can be a challenging and a sensitive process when creating guidelines for transgender athletes in sport, however, there needs to be well established rules in order to maintain fair play.

Research should continuously be completed to know what is right for individuals involved. For example, doctors and scientists should be completing normal hormone level checks, such as testosterone, to know baseline normal ranges for various genders. This would help dictate levels that should be seen in transgender athletes.

Not only should regulators continue their education with transgender athletes, but so should coaches and other teammates. It can be a scary process for someone who is transgender to have the courage to play a sport where they may not be very accepted. Coaches, and other team administrators should have the education on what their athletes should be doing whether it be through hormone replacement therapy, training, or nutrition consumption to make sure their athlete is not only in prime competition mode, but also so they are able to compete without any furthering testing problems. By having continuing education for all parties, fair play of the game will stay intact.

Gene manipulation

Gene treatment and manipulation were added in WADA's list of prohibited substances in 2004 and have since then been updated. In 2013, WADA defines gene doping as, "the transfer of

polymers of nucleic acid analogues” (8). There have been many cases to occur with gene manipulation including EPO and GH. Athletes have considered using new discoveries in gene therapy is distorted ways, when in reality they are supposed to be used for the benefit of human health (16).

Athletes may consider using gene therapy in order to alter a specific substance, hormone, or enzyme, which may in return help to improve their performance. These future therapies are supposed to be used for improving an ill one with diseases, but some may take advantage of this. Athletes could try to manipulate their genes in order to enhance their physical attributes which may allow them to perform more efficiently. They may do this by “increasing the production of some performance-related proteins” (8).

Regulators may consider genetic screening as a method of evaluating individual genes or chromosome patterns. However, these screenings may question the ethics of sport and if it is discriminating towards athletes who are naturally born with certain genes that may put them at an advantage over others.

Scientists should use practical applications when considering helping a patient through gene therapy. It is important for there to be knowledge of what this means and include the side effects (8). Athletes need to be aware that this can influence their ethical fairness to their performance and sport. It is something that is not tolerated by the governing bodies who watch over fair play.

Designer babies/CRISPR Cas-9

In continued news of gene therapy, there may be ways to genetically engineer a human before they are even born. Designer babies can be created by altering the human germline which

essentially targets a specific DNA sequence in human embryos that is passed down through generations. Right now, the model used is the CRISPR-Cas9.

The science is still so new behind it that the ethical questions are still in play. Countries have different laws and regulations regarding the CRISPR-Cas9 use. Right now, most countries only want scientists using it for fighting diseases or development issues that could be passed to the embryo. The family may be pre-aware of these situations and wish to act upon them (19).

However, it is important to be proactive in these cases. Through uses of new technology, humans could genetically engineer certain parts of their child to make them better at certain skills or possess certain traits. For example, it could be possible for parents to genetically engineer certain muscle fiber types that their child could carry. If the parent chooses that they want their child to be successful in endurance-based sport, they could alter the fiber type tissue, so the child possess more Type 1 Muscle Fibers, than Type 2.

SECTION SEVEN

Summary

PEDS are known to be potent and harmful to the human body, yet some athletes still decide to indulge in them. Governing bodies have been created in hopes of combating athletes from taking such substances, such as blood doping. It is important for the athlete to be aware of the side effects of such drugs and that the majority are illegal to take both during and outside of competition. Governing bodies need to constantly look into new and developing PEDS and make sure their regulations are correct. Athletes have been known to go 80-90% of their career taking PEDS and not getting caught. Education for athletes and their teams could eliminate a lot of this usage. Athletes in the past who have had experience could also come forward and share their

story and experience with PEDS and why they should not be taken. Sporting organizations such as the MLB and Cycling Union should consider education programs for PEDS. It is unsure if there is a way to minimize how athletes abusing PEDS in the future, but there is a chance. WADA and the IOC have put together a detailed prohibited substance list that athletes and their teams can follow to know exactly what is prohibited. It is extremely important for these governing bodies to continue looking for new advances in medicine.

Prevention>reaction

PEDS will always be a concern in sport. There will always be development of new drugs and technology. It is important that governing bodies are continuing education and research in a proactive manner to try and combat the use of PEDS. Topics such as transgender athletes and genetic engineering is the next pressing controversy sport will face regarding ethical standards. It is important for everyone involved including athletes, coaches, and peers to think about their ethical judgement and moral reasoning before involving themselves in a situation. This is in hopes to keep the athlete healthy and keep sport fair.

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