Injury and illness among athletes during a multi-day elite cycling road race

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Abstract
Objectives: Although road bicycle races have been held for more than a century, injury and illness patterns during multi-day bicycle events have not been widely studied. The aim of this study was to determine the incidence of injury and illness among riders and describe the medical care interventions provided to participants of cycling road races.

Methods: A prospective observational study was conducted on the Presidential Cycling Tour of Turkey, which was held between April 26 and May 3, 2015. The race lasted 8 days and covered 1258 km of road. There were 166 elite cycling athletes representing 21 teams from various countries. Data collected pertaining to incidents involving injury or illness included the following: type of injury; anatomical location of injury; details of the medical encounter; location of the intervention; treatment provided; medication administered and disposition of the rider. An injury was defined as a physical complaint or observable damage to the body produced by the transfer of energy of the rider. An illness was defined as a physical complaint or presentation not related to injury.

Results: The overall incidence (injury and illness) was 5.83 per 1000 cycling hours. (Injury incidence was 2.82 vs illness incidence of 3.01 per 1000 hours cycling). A total of 31 incidents occurred. Of these, 15 were injuries, while 16 were complaints of a non-traumatic nature. A total of 43 interventions were made in the 15 cases of injury. The most commonly injured body regions were limbs; the majority of injuries involved the skin and soft tissue. The most common medical intervention was wound care (64% of all interventions). Two riders had to withdraw from the race, and one was hospitalized due to a traumatic pneumothorax. None of the non-traumatic cases resulted in withdrawal from the race.

Conclusions: A broad spectrum of illness and injury occurs during elite multi-day road races, ranging from simple skin injuries to serious injuries requiring hospital admission. Most injuries and illnesses are minor; however, medical teams must be prepared to treat life-threatening trauma.

Introduction
Bicycle road races are held in many parts of the world every year. Although many athletes are injured, withdraw from the race or are hospitalized, injury patterns during bicycle road races have not been widely studied. The medical literature in this area has mainly focused on mountain bike and off-road races.[1–6] Additionally, during challenging road races, riders may also be exposed to various diseases. There is scant information available in the literature to inform the planning of medical services during such races.[7–10] Injury surveillance has become increasingly recognized as an important component of sports medicine. There is a recent report of road cycling injuries, including Pro-Cycling teams by Barrios et al.[11] They showed professional road cyclists are exposed to double the risk of traumatic injuries than those competing in the 1980s and early 1990s.

The Presidential Cycling Tour of Turkey (TUR) is a prestigious multi-day annual bicycle race organized by the Turkish Cycling Federation that has been increasing in popularity among elite athletes.[12] The race follows the regulations set forth by the Union Cycliste Internationale (UCI), a global authority for cycling events. TUR is registered in the European UCI event calendar as a category 2 HC event (one level below World Tour races such as Tour de France), signifying a multi-day event with participants that include UCI ProTeams, UCI professional continental teams, UCI continental teams (of the country the race is in) and National teams (of the country of the organizer).[13]

Although many mass gatherings and sporting events have similar basic medical coverage needs, elite bicycle road race events have unique medical response challenges. The purpose of this study is to determine the incidence of the injury and illness among athletes participating in the 51st annual TUR
and the treatment provided. We also present experience-based treatment options and recommendations for the planning of similar events.

**Methods**

**Study setting**

This study was conducted between April 26 and May 3, 2015, during the 51st annual TUR event. The race participants included 166 athletes representing 21 teams. All riders were male. The cyclists covered 1258 km over 8 days (124–185 km/day), with average speeds of 33–47 km/h. The health-care team comprised one physician faculty member, two senior emergency medicine residents, two emergency medical services physicians, one general practice physician, six paramedics and six emergency medical technicians. The chief medical officer of the tour is an emergency medicine residency-trained physician who has participated in the TUR for the past 4 years. Transportation resources for the team consisted of two cars, three motorcycles and four ambulances. The entire health-care team travelled with the group of cyclists in a convoy; a total of 1200 technical and support personnel supported the race. The lead vehicle was a physician car following the peloton (the main group of riders in a road bicycle race), while the second physician car followed the technical vehicles. In each physician car, there were two physicians (one in the front passenger seat and the other in the rear left seat) along with a non-medical driver. Perhaps unique to bicycle racing, medical intervention was provided from the windows of the car on either side while the vehicles were in motion. The cyclist could approach the vehicle and ask for medical care without leaving the race. In case of a crash, the second physician car took over as the lead. In each of the vehicles assigned to the medical team, there was a two-way radio with a race channel over which crashes were communicated between medical team members.[14] In each medical vehicle, there were jump kits (portable doctor handbag) to be used outside of the vehicle by medical care providers in case of a crash. These kits contained basic wound care supplies and a limited supply of medications. The list of medications was scrutinized to assure compliance with the current restrictions published by the World Anti-Doping Agency.[15] The ambulances were full-service transport vehicles equipped to respond to major trauma and medical emergencies with a comprehensive supply of equipment including supplies and medications approved by the Ministry of Health. Medical care was provided before and after the race at the start and finish lines, during the race from moving vehicles and on the scene of crashes.

**Definition of injury and illness**

Injury and illness are defined in accordance with the published Consensus Statement of Epidemiological Studies in Athletics.[16] An injury is defined as a physical complaint or observable damage to body tissue produced by the transfer of energy experienced or sustained by a rider during a race. An illness is defined as a physical complaint or presentation not related to injury.

**Data collection**

Data were collected using standardized forms that were developed a priori (see supplemental file, entitled “data collection form”). The forms were disseminated among the medical care team and training on form completion and clear definitions of terms were provided during a session one day prior to the start of the event. The health-care provider evaluating the patient documented each encounter on the forms. The forms were reviewed at the end of each day, and an opportunity was provided to complete missing data fields in order to minimize recall bias (see supplemental file, entitled “general data form”). Data on the forms included the following: whether the encounter involved an injury or illness, type of injury, anatomical location of injury, details regarding the medical encounter, location of intervention, treatment provided, medication and supplies used, and disposition of the patient. All medical encounters were included. Providing assistance in getting back on the bicycle after falls and other similar interventions were not logged as medical care. Only medical interventions to riders were included in the study. Narrative information was also collected using the data collection form and reviewed at the end of each day. Detailed data on demographics of the riders could not be obtained due to the intense atmosphere of the race and in order not to interrupt the race.

The study was reviewed and approved by the Clinical Research Ethics Committee of Dokuz Eylul University.

**Data analyses**

The overall incidence was calculated as number of new injuries or illnesses recorded during the study period divided by a total race time and presented as injuries per 1000 hours cycling. Frequency of injury and illness were presented as percentage of all cases.

**Results**

The mean age of injured cyclists and those suffering from non-traumatic complaints was 28.7 (range 22–44). A total of 31 medical incidents occurred during the race. The overall incidence (injury and illness) was 5.83 per 1000 hours cycling (injury incidence was 2.82 vs illness incidence of 3.01 per 1000 hours cycling). The numbers of injuries, non-traumatic complaints, transfers to hospital and withdrawals from the race according to stage are presented in Table 1. Fifteen incidents were traumatic, while 16 were associated with non-traumatic causes. The number of medical interventions for the trauma-related injuries was 43, while the total number of interventions was 59. The number of injuries per incident was found to be 2.86. Table 2 shows the distribution of traumatic injuries, and Table 3 details the types of non-traumatic incidents.

Three riders (1.8%) required transportation to a hospital emergency department, all as a result of traumatic injuries. Two of these three riders (1.2%) were unable to complete the race. One patient sustained a traumatic pneumothorax requiring tube thoracostomy. A closed reduction was performed on another with a dislocated shoulder. One rider sustained an elbow laceration that was bandaged during the race and...
Table 1. Number of traumatic injuries and illnesses, hospital transport and race withdrawal.

| Stage | Distance (km) | Duration | Injuries | Non-traumatic complaints | Transfer to hospital | Race withdrawal |
|-------|---------------|----------|----------|--------------------------|----------------------|-----------------|
| 1     | Alanya – Alanya | 145      | 3 h 18 min | –                        | 1                    | –               |
| 2     | Alanya – Antalya | 182      | 4 h 15 min | 3                        | 2                    | –               |
| 3     | Kemer – Elmali  | 165      | 4 h 38 min | 1                        | 1                    | –               |
| 4     | Fethiye – Marmaris | 132      | 4 h 25 min | 4                        | 2                    | 1               |
| 5     | Muğla – Pamukkale | 160      | 4 h 19 min | 3                        | 2                    | –               |
| 6     | Denizli – Selçuk | 184      | 4 h 22 min | 2                        | 6                    | –               |
| 7     | Selçuk – İzmir | 166      | 3 h 54 min | 1                        | –                    | 1               |
| 8     | İstanbul – İstanbul | 124      | 2 h 43 min | 1                        | 2                    | 1               |
| Total |                | 1258     | 3 h 54 min | 15                       | 16                   | 3               |

Table 2. Type and frequency of traumatic injuries.

| Types of traumatic injuries                           | Number of injuries (n = 43) (% of cases) |
|-------------------------------------------------------|------------------------------------------|
| Skin and soft tissue                                  | 38 (87)                                  |
| Abrasions/superficial skin injuries (road rash)       | 36 (83)                                  |
| Lacerations requiring suture                          | 2 (4)                                    |
| Fracture                                              | 1 (3)                                    |
| Dislocation                                           | 1 (3)                                    |
| Pneumothorax                                          | 1 (3)                                    |
| Concussion                                            | 2 (4)                                    |

Table 3. Type and frequency of medical complaints.

| Non-traumatic complaints                               | Number of non-traumatic complaints (n = 16) | Percentage of cases |
|-------------------------------------------------------|---------------------------------------------|---------------------|
| Musculoskeletal pain                                  | 6                                           | 37                  |
| Leg                                                   | 1                                           | 6                   |
| Knee                                                  | 4                                           | 25                  |
| Ankle                                                 | 1                                           | 6                   |
| Gastrointestinal                                      | 4                                           | 25                  |
| Diarrhea                                              | 2                                           | 12.5                |
| Abdominal pain                                        | 2                                           | 12.5                |
| Ophthalmological                                      | 3                                           | 20                  |
| (conjunctivitis)                                      |                                             |                     |
| Fever (self-reported)                                 | 1                                           | 6                   |
| Exhaustion                                            | 1                                           | 6                   |
| Headache                                              | 1                                           | 6                   |

Table 4. Anatomic location and frequency of traumatic injuries.

| Anatomic location of traumatic injuries | Number of injuries (n = 43) (% of cases) |
|----------------------------------------|------------------------------------------|
| Lower limb                             | 17 (39)                                  |
| Upper limb                             | 15 (35)                                  |
| Head/face/neck                         | 4 (9)                                    |
| Shoulder                               | 4 (9)                                    |
| Thorax                                 | 2 (5)                                    |
| Hip                                    | 1 (3)                                    |

sutured after the stage. He was able to return to the race the following day. None of the competitors required transfer to a hospital for non-traumatic causes. No deaths occurred. Injury severity scores were not calculated, because most injuries were minor.

The most commonly injured body regions were the lower limbs, followed by upper limbs, head/face/neck, shoulder, thorax and hip (Table 4). The most common lower extremity area of injury was the knees, which accounted for 13 (23%) of the incidents.

The locations of the interventions were as follows: 2 riders (6%) were cared for at the start area, 28 riders (85%) required care during the race and 3 riders (9%) received care in the finish area at the end of the race. Twenty-two (66%) interventions were provided through the window of the physician’s vehicle, while six (19%) interventions were performed at the side of the racetrack, where the rider stopped due to a fall or crash. Two riders received medical care both during and after a leg of the race.

The most common medical intervention during the race was wound care, which accounted for 38 incidents (64% of all interventions). In most cases, these injuries were due to sliding after falls, resulting in typical wounds/abrasions contaminated with soil and grit, often referred to as road rash. Irrigation was performed using normal saline or tap water after particulate debris was removed and the wound was scrubbed. Disinfection was subsequently carried out with povidone-iodine (Betadine®) spray. Antibiotic ointment (nitrofurazone (Furacin®)) was applied to the wounds. Tubular elastic net bandages and self-adhesive sterile pads were used to cover the wounds.

The majority of non-traumatic complaints were related to musculoskeletal pain. An oral non-steroidal anti-inflammatory (diclofenac sodium) was given and ice was applied to the affected area to treat these patients. The other non-traumatic complaints were traveler’s diarrhea and abdominal pain. These riders were administered 4 mg loperamide (Loperamid®) from the TUR medical vehicle during the race to treat their diarrhea. No cyclist withdrew from the race because of diarrhea or required treatment for symptoms such as dehydration and other systemic complications.

**Remarkable medical events**

**Acute allergic reaction to pollen**

The TUR was held during the spring; due to the high pollen count between the towns of Denizli and Selçuk, three riders presented to the first medical vehicle with burning, watery and itchy eyes. The presentations occurred sequentially within 45 min of passing through a wooded area. All three riders had red eyes with clear watery discharge. They described not being able to see well because of their watery eyes. One patient was also observed to have edema of the eyelid. “Acute allergic conjunctivitis due to pollen” was suspected. The eyes of all three riders were irrigated and wiped with a sponge. Subsequently, histamine blocker drops (Zaditen®) containing the active ingredient ketotifen was administered.
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Life-threatening accident

A single rider in the peloton crashed on a straight stretch of road. The rider somersaulted a few times and was found to have active bleeding in the frontal area above his left eyebrow under his intact helmet. During the initial assessment at the incident site, the cyclist was confused and slightly agitated. His airway was intact and he had no difficulty breathing. His radial pulses were strong. He could move all four of his extremities and had no obvious deformities. Dermal abrasions were seen on both elbows, both knees, the anterior of the left iliac spine, the left shoulder and the palmar surfaces of both hands. The bleeding in the frontal region was controlled using external pressure. The patient was properly placed in a rigid cervical collar, immobilized on a spine board and taken to the nearest state hospital by ambulance. The patient complained of severe pain in the left hemithorax and was agitated. Suspected of sustaining a serious thoracic injury, the patient was monitored by pulse oximetry during transportation; his vital signs, including SpO2, remained stable, and there was no deterioration in his state of consciousness. The lung radiograph taken at the hospital revealed left rib fractures and a 25% pneumothorax. Focused abdominal sonography for trauma, brain and abdominal CT scans performed at this medical center did not reveal any additional pathology. A left tube thoracostomy was performed. The patient was transferred to Izmir Dokuz Eylül University Hospital, a tertiary care center. A thoracic CT revealed an expanded left lung, a non-displaced fracture of the 7th left rib, displaced fractures of the 4th, 5th and 6th left ribs and contusion of the superior lower lobe of the lung. The patient was admitted to the thoracic surgery department; his thoracostomy tube was removed on day 3, and he was discharged on day 5.

Feed zone accident

The name “feed zone” is given to the 1-km stretch of road in the middle of each stage where the competitors are provided with food and liquid support in a fabric carrier. In this zone, the vehicle for each team stops and a supporting team member hands over the fabric carrier to the selected rider of his team while he is cycling. During the Denizli–Selçuk stage, one of the riders, in attempting to hang the food carrier round his neck, lost his balance and fell. An attempt was made to intervene, but the rider declined medical assistance and continued with the race. During the race, the rider approached the medical vehicle and was seen to have bleeding of the chin with a 4 × 3 cm wide dermal abrasion, bleeding of the philtrum with a 2 × 1 cm dermal abrasion, a 1 × 1 cm dermal abrasion on the sternum and abrasions on both knees. While moving with the vehicle, a gauze bandage was applied to the wound on his chin to stem bleeding, and the wound was covered.

Shoulder injury resulting in withdrawal from the race

Two cyclists from the same team crashed during the final stage of the race when a stray dog wandered onto the course. One cyclist complained of left shoulder pain and restricted abduction. The physical examination conducted at the scene revealed a painful restriction of range of motion in the left shoulder. There was no single point of pain or deformity observed over the clavicle. Upon inspection, the left shoulder was lower than the opposite shoulder and there was an epaulette sign. A clinical diagnosis of acromioclavicular joint separation or shoulder dislocation was suspected. The rider was unable to continue racing due to severe pain and tenderness in the shoulder. He was taken to a hospital non-urgently for imaging and was diagnosed with a shoulder dislocation, which was reduced.

Discussion

In our study, the most frequently seen injury involved the extremities and the most frequent forms of injury were surface dermal abrasions not requiring sutures (road rash) and soft tissue contusions. This is consistent with other studies of cycling races and recreational cycling tours.[1,3,4,8,10,17,18] However, studies conducted on mountain bike- (MTB) and off-road races have found fractures to be the most common form of injury.[1,2] We believe that this is related to the rugged track condition.[19] Similarly, Pfeiffer and Kronisch [20] indicated that off-road cyclists sustain more fractures, dislocations and concussions than their road-event counterparts.

In road races, the cyclists travel with average speeds of 35–45 km/h on flat ground and they reach about 90–100 km/h downhill.[12,21,22] In road bicycle racing, speeds are high and when cyclists crash, they are dragged and sustain a large number of surface dermal abrasions, which are often contaminated with particulate matter and asphalt (road rash).[8,18]

In our study, most of the injuries were superficial and were handled by the TUR medical team. As most of the cyclists who crashed wished to continue racing, it was necessary to quickly clean and care for the wounds sustained. The requirement for effective and rapid irrigation was recognized based on previous experiences with the TUR. With this in mind, a standard 1-L handheld plastic spray bottle was used. Normal saline, which was stored in sterile bottles prior to the race, was decanted into the reservoir, and all wounds were copiously force-irrigated and covered with gauze bandages. In order to secure the gauze bandages overlying the wounds, we used tubular elastic net bandages (Figure 1). This material is easily pulled over the extremities and is capable of securing wound coverings on mobile areas such as the joints and extremities. We received feedback from the cyclists that these bandages were very practical and were well tolerated during the race. Furthermore, self-adhesive sterile wound pads were practical for large surface area wounds that were distant from joints. Their self-adhesive nature and varying dimensions provided an advantage with regard to rapid wound care; they did not require additional tape.

In our study, the cyclists complained mainly of musculoskeletal pain. We noted that the riders who were in pain approached the medical vehicle during the first hour of the race requesting oral analgesics. This suggests that the pain could be related to strains (overloading) sustained during the warm-up period.[8] The second most common non-traumatic complaint in our study was gastrointestinal pathology.

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In the study of a recreational cycling tour conducted by McGrath et al., gastrointestinal complaints were the most commonly encountered medical condition. The shoulder area is one of the most commonly injured areas in cycling accidents. In our race, one elite rider was forced to withdraw from the competition from a shoulder injury sustained in a crash.

Sports-related concussion is common and as many as 50% of concussions may go unreported. We diagnosed two cases of concussion characterized by a transient loss of consciousness in cyclists who crashed and struck their heads. One of these was the patient who was hospitalized with chest trauma. The other’s consciousness fully opened within seconds on scene, and continued racing. We evaluated the rider the following day. He could not remember the moment of the accident. There were no neurological sequelae in either of the cyclists.

Although the dangers of the feed zone are well known in the cycling world, there are no publications related to this topic in the medical literature. The non-medical literature contains reports of fatal accidents in this zone, including a report of a 54-year-old woman who was killed in a feed zone after a rider lost control of his bike.

Life-threatening trauma and trauma-related fatalities have been encountered in elite bicycle road races. The serious injury that took place during stage seven in this study was managed by the responding physicians and ambulance team. A rapid assessment was performed and initial treatment was given on the scene of the crash. The appropriate expertise and equipment for stabilization were immediately available at the time of the crash.

Although we did not experience any non-traumatic emergencies, sporting competitions can, on rare occasions, be the scene of acute cardiac emergencies. Therefore, the skill of the medical personnel employed in sporting competitions and the equipment available must be assessed prior to the event so that any deficiencies can be addressed.

Most of the interventions were made from the medical vehicle (Figure 2). Because the back windows of the two medical vehicles did not fully open, the physicians had difficulty treating the patients. This restriction was even more pronounced during interventions requiring physical manipulation, particularly in cases of wound care. The vehicles used in future events will be screened for appropriateness.

Injured athletes are different from injured patients seen in the emergency department. We observed that the athletes are often not concerned about minor injuries and generally desire to continue the race. However, it is incumbent upon the clinician evaluating the patient to thoroughly evaluate the patient and determine his appropriateness to return to competition, particularly in cases involving concussion or other injuries, which may pose a danger to the injured athlete or other cyclists. In this race, most injuries required rapid and minimal interventions during the race with advanced interventions reserved for the finish line aftercare. The safety and integrity of the intervention zone following an accident was often compromised by spectators and other vehicles in the convoy. Future improvements may include a safety team to secure the crash scene and provide a protected zone for clinicians.

There were elements of the race that generated a stressful environment for the medical team. The constant movement of the convoy, filming by the camera crew of the live broadcast of the race to many countries during medical interventions, the close proximity of individuals getting out of their team vehicles in the event of a crash, and the competitors’ urgency to continue racing were some of the factors that heightened the stress levels of the medical team.

![Figure 1. “Tubular Elastic Net Bandage.” This bandage was ideal as a cover for wounds, as it was rapidly applied over the extremities and maintained its integrity over joints. (Tour of Turkey, Start Area).](image1)

![Figure 2. Closure of the wound on the lateral thigh with self-adhesive sterile pads and Tubular Elastic Net Bandage on the elbow. (Tour of Turkey, during the race).](image2)
Strengths and limitations of this study and future directions

This is the first study to present detailed observational information regarding the medical aspects of a cycling road race. Issues well known to the cycling community, such as the danger of the feed zone, road rash, and life-threatening accidents, were presented and discussed from a medical perspective. This descriptive study was conducted on only one race; therefore, the number of illnesses and injuries in our study is limited. Injuries treated by the team doctor may not have reached us. And also experienced-based understanding of the unique dynamics of the race will provide better medical coverage for future road bicycle races.

The problems caused by the lack of uniform surveillance methods in this type of sporting event have been recognized and discussed. For future studies, the use of a consensus statement on injury and illness definitions and data collection procedures would lead to more reliable and comparable evidence and facilitate meaningful interpretations and comparisons of results.[16,34,35]

Conclusion

This study demonstrated that hospital transfers due to medical causes during road bicycle races and athlete withdrawal from elite races may be possible. Minor medical incidents are readily managed by a tour medical team using proper equipment and supplies. Although rare, serious trauma can occur, and a health team with the appropriate equipment must be present to handle such events.

Declaration of interest

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

Supplemental data

Supplemental data for this article can be accessed here.

References

[1] Chow TK, Kronisch RL. Mechanisms of injury in competitive off-road bicycling. Wilderness Environ. Med. 2002;13:27–30.
[2] Ashwell Z, McKay MP, Brubacher JR, et al. The epidemiology of mountain bike park injuries at the Whistler Bike Park, British Columbia (BC), Canada. Wilderness Environ Med. 2012;23:140–145.
[3] McGrath TM, Yehl MA. Injury and illness in mountain bicycle stage racing: experience from the Trans-Sylvania Mountain Bike Epic Race. Wilderness Environ Med. 2012;23:356–359.
[4] Nelson NG, McKenzie LB. Mountain biking-related injuries treated in emergency departments in the United States, 1994–2007. Am J Sports Med. 2011;39:404–409.
[5] Becker J, Runer A, Neunhäuserer D, et al. A prospective study of downhill mountain biking injuries. Br J Sports Med. 2013;47:458–462.
[6] Aleman KB, Meyers MC. Mountain biking injuries in children and adolescents. Sports Med. 2010;40:77–90.
[7] Reifferscheid F, Sturh M, Harding U, et al. Medical coverage of a road bicycle race. Anesthesiol Intensivmed Notfallmed Schmerzther. 2010;45:456–462.
[8] Roi GS, Tinti R. Requests for medical assistance during an amateur road cycling race. Accid Anal Prev. 2014;73:170–173.
[9] Martinez JM. Medical coverage of cycling events. Curr Sports Med Rep. 2006;5:125–130.
[10] Yan CB, Rubin AL. Equipment and supplies for sports and event medicine. Curr Sports Med Rep. 2005;4:131–136.
[11] Barrios C, Bernardo ND, Vera P, et al. Changes in sports injuries incidence over time in world-class road cyclists. Int J Sports Med. 2015 36(3):241–248.
[12] Wikipedia contributors. List of professional cyclists who died during a race. Wikipedia, The Free Encyclopedia [Internet]. [cited 2015 Sept 28]. Available from: https://en.wikipedia.org/wiki/List_of_professional_cyclists_who_died_during_a_race
[13] The Union Cycliste Internationale (UCI). UCI website [Internet]. [cited 2015 Sept 30]. Available from: http://www.uci.ch/
[14] 51st Presidential Cycling Tour of Turkey Race Regulations. Tour of Turkey website [Internet]. [cited 2015 Sept 28]. Available from: https://tourofturkey.org/2015/race-regulations
[15] List of prohibited substances and methods. The World Anti-Doping Agency website [Internet]. 2015. [cited 2015 Sept 28]. Available from: http://list.wada-ama.org/
[16] Timpka T, Alonso J-M, Jacobsson J, et al. Injury and illness definitions and data collection procedures for use in epidemiological studies in athletics (track and field): consensus statement. Br J Sports Med. 2014;48:483–490.
[17] Emmond SD, Tayoun P, Bedolla JP, et al. Injuries in a 1-day recreational cycling tour: Bike New York. Ann Emerg Med. 1999;33:56–61.
[18] Cook N. How to deal with road rash. BikeRadar [Internet]. 2014. Available from: http://www.bikeradar.com/gear/article/how-to-deal-with-road-rash-23619/
[19] Wikipedia contributors. Mountain biking. Wikipedia, The Free Encyclopedia [Internet]. [cited 2015 Sept 28]. Available from: https://en.wikipedia.org/wiki/Mountain_biking
[20] Pfeiffer RP, Kronisch RL. Off-road cycling injuries. An overview. Sports Med. 1995 19(5):311–325.
[21] Wikipedia contributors. Cycle sport. Wikipedia, The Free Encyclopedia [Internet]. [cited 2015 Sept 28]. Available from: https://en.wikipedia.org/wiki/Cycle_sport
[22] Tour de France average speed. UCI website [Internet]. [cited 2015 Sept 28]. Available from: http://www.uci-travel.com/glossary/tour-de-france-average-speed/
[23] Ueblacker P, Rathmann W, Rueger JM, et al. Acute injuries in road bicycle racing. Injury surveillance at the Hamburg UCI ProTour“Cyclacuses“ 2006. Unfallchirurg. 2008;111:414–420.
[24] Silberman MR. Bicycling injuries. Curr Sports Med Rep. 2013;12:337–345.
[25] Kelly JP, Nichols JS, Filley CM, et al. Concussion in sports. Guidelines for the prevention of catastrophic outcome. JAMA. 1991;266:2867–2869.
[26] Harmon KG, Drezner JA, Gammons M, et al. American Medical Society for Sports Medicine position statement: concussion in sport. Br J Sports Med. 2013;47:15–26.
[27] Wall L. The feed zone - tips for hand ups. Cycling Skills. 2009. Available from: http://cyclingskills.blogspot.com.tr/2009/05/feed-zone-tips-for-hand-ups.html
[28] Clarke S. Spectator dies after Belgian feedzone crash. Cycling Weekly [Internet]. 2015. Available from: http://www.cyclingweekly.co.uk/news/latest-news/spectator-dies-after-belgian-feed-zone-crash-160599 (cited 2015 May 29).
[29] Noakes TD. Fatal cycling injuries. Sports Med. 1995;20:362.
[30] Wikipedia contributors. List of professional cyclists who died during a race. Wikipedia, The Free Encyclopedia [Internet]. [cited 2015 Sept 28]. Available from: https://en.wikipedia.org/wiki/List_of_professional_cyclists_who_died_during_a_race
[31] Sensmian C, Sweeting J, Ackerman MJ. Sudden cardiac death in athletes. Br J Sports Med. 2015;49:1017–1023.
[32] Marijon E, Uy-Evanado A, Reinier K, et al. Sudden cardiac arrest during sports activity in middle age. Circulation. 2015;131:1384–1391.

[33] Cohen SI, Ellis ER. Death and near death from cardiac arrest during the Boston Marathon. Pacing Clin Electrophysiol. 2012;35:241–244.

[34] Fuller CW, Ekstrand J, Junge A, et al. Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. Clin J Sport Med. 2006;16:97–106.

[35] Mueller-Wohlfahrt H-W, Haensel L, Mithoefer K, et al. Terminology and classification of muscle injuries in sport: the Munich consensus statement. Br J Sports Med. 2013;47:342–350.