

## **FACTORS RELATED TO THE INCIDENCE AND SEVERITY OF INJURIES IN TEAM HANDBALL**

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### **SUMMARY**

The aim of this study was to determine incidence and severity of injury in Greek team handball and to correlate the endogenous factors, the type of exercise and the environment of team handball with the injuries of players at different levels. The study sample consisted of 216 male team handball players. Each player individually completed a self-reported questionnaire related to the injuries they had sustained for the duration of the previous 24 months. The results showed a high incidence and severity of injuries (42.6%) and (64.2%) respectively. The incidence of injuries had a correlation with the competitive level, previous injuries and the localization of an injury. The severity of an injury had a correlation with the hospitalization. The time of an injury, (that is, during training or at a match) also had a correlation with the competitive level of the players. Previous injuries showed a correlation with the recurrence of these injuries. In conclusion, it can be ascertained that team handball belongs to sports with a high risk factor for injury. The incidence, the severity, the localization, the need for hospitalization, the time as well as the recurrence of injuries, the competitive level of the players, previous injuries, and the level of competition are all related factors.

Key words: Injuries, factors, team handball, Greek championship

### **INTRODUCTION**

It is well-known that handball is a sport which demands the player to move around the playing field at high speed, throwing the ball, jumping, and reacting quickly. A team handball player needs strength, ability and endurance (Wolf et al., 1974). These requirements along with the particularities of the sport, such as, the frequent and intense physical contact with the opponent player, often result in injuries (Andren-Sandberg, 1994). In the area of sport medicine it is well-known that handball has a high incidence of injury and that these injuries are frequently severe (Leindinger, Gast and Pforringer, 1990; Tyrdal and Bahr, 1996), which has been shown by many researchers (Bak and Koch, 1991; De Loes, 1995; Lindblad, Hoy, Terkelsen, Helleland and Terkelsen, 1992). If we consider that the majority of these injuries in handball players is unavoidable (Aronen, 1991; Asembo and Wekesa, 1998), most of the injured athletes are absent from training for over one week (Lindblad et al., 1992; Nielsen and Yde 1988), while a significant percentage stop playing the sport after sustaining an injury (Lindblad, Jensen, Terkelsen, Helleland and Terkelsen, 1993), it can easily be understood that injuries in team handball are an important factor in this sport.

Koplan, Siscovick and Goldbaum (1985), state that the definition of injury refers to a physical destruction usually musculoskeletal, and that the difficulty in defining the risk factor of an exercise is due to the actual complexity of the exercise itself. People who perform a physical activity have not only a different level of intensity but also execute that activity in various ways, this in turn results in differing performances as well as a variety of risk factors. The same researchers claim that in order to reduce the risk factors we must examine the interaction of three elements: the endogenous factors, the mean and the environment.

The endogenous factors are age, gender, physical condition, family history, smoking, other habits and the life-style of each player. The mean can be defined as the actual type of exercise which has a diversity in proportion to speed, duration, frequency and warm up. Environmental factors are climatic conditions, the ground and the surface of the floor, the soles of the athletic shoes and the place where the exercise occurs. The authors conclude that from clinical studies that have been carried out, injuries may be related to the special patterns which an exercise has each time. Moreover, they claim that the incidence of injuries is related to the

type of exercise, how often and how intensely it is performed, the personal characteristics of the individuals, as well as environmental factors.

From the literature review, it seems that the factors related to injuries in team handball have not clearly been defined (Conteduca, Ferretti, Mariani, Puddu and Perugia, 1991; Dirx, Bouter and de Geus, 1992; Hoerbig, van Galen and Philipsen, 1986). In addition, it appears that a low level of physical fitness, error in technique, lack of flexibility as well as inadequate treatment and rehabilitation may also be related to injuries (Aronen, 1995; Lund-Hanssen, Gannon, Engebretsen, Holen and Hammer, 1996; Read and Wade, 1988). Further, the risks of an injury are greatly increased, especially for young athletes, when they are called on to meet often the excessive demands of a high performance game too soon after an injury (Abatzides, 1998). At this point the important role that some environmental factors play, must also be mentioned examples include, the correct application of the rules by referees, the material of the playing surface where the game or the training takes place, the appropriate shoes and the dimensions of the court. All these factors seem to contribute to injuries (Boden, Griffin and Garrett, 2000; Jorgensen, 1984; Read and Wade, 1988).

From an examination of all the above elements it can be seen that in order to decrease injuries, it is necessary to determine the degree of prevention as well as reduce the risk factors which result in these injuries. Until now there has been little research which gives reliable data on the correlation between risk factors and injuries. This fact has led to the objectives of this study which were 1) to determine the incidence and severity of injury in Greek team handball across different competition levels 2) to correlate the endogenous factors, the type of exercise as well as the environmental factors with the injuries which occur in team handball players of different levels.

## **METHOD**

### *Sample*

The total sample size of the study consisted of 216 male team handball players who were in 6 teams of the A1 Division, 6 teams in the A2 and B Divisions and 6 teams of the Local Championship. These athletes participated in the championships of each competition for the duration of one season. All athletes were regular participants of the teams and took part in the championship. The 18 teams were placed into three categories depending on the level of the players' performance which were: a) 72 athletes from 6 teams of the high performance level, those in the A1 Division, b) 72 athletes from 6 teams of the intermediate level, those in the A2 and B Divisions, and c) 72 athletes from 6 teams of the low level, those in the Local Championship.

### *Research tools*

All athletes were given a self-reported questionnaire developed specifically for this research. The questionnaire was related to the injuries the players had sustained during their involvement with the sport within the period of the last 24 months. An injury was defined as an accident sustained during practice or competition, which led to a medical problem (e.g., pain, disability) and prevented participation (training or playing) for at least one day beyond the date of occurrence (Gibbs, 1993; Hodgson, Standen and Batt, 1998). More specifically, at the beginning of the questionnaire each player was required to give information and data on personal characteristics such as age weight, height, his history of athletic activity and participation. In addition, each player gave further information on warm up exercises, prophylactic equipment, stretching exercises and technical training. In the main part of the questionnaire, information was required on injuries which the players had sustained during the last two years. For instance, the incidence, severity (injuries were graded into four categories of severity): mild (absence from practice less than 1 week), moderate (absence between 1 and 2 weeks), serious (absence between 2 and 4 weeks), and severe (absence of more than 4 weeks) (Seil, Rupp, Tempelhof and Kohn, 1998), the percentage of players who had to be hospitalized, localization, time (that is, during training or at a match) and recurrence of an injury, as well as previous injuries were recorded (each player was asked if had sustained previous injuries in the same location he had had an injury). Finally, information was asked about various environmental factors, such as the surface of the field, the soles of the player's shoes as well as the place where the injuries occurred.

### *Procedure*

The questionnaires were suitably formed and were completed by each player separately during the visit made by the researchers at one of each teams' training sessions. The completion of the questionnaires was done during championship matches of each level over a three-month period. Participation in the study was voluntary. If an injury was listed, more questions had to be answered regarding severity, localization, time (that is, during training or at a match) and recurrence. The researchers were present to answer any questions posed by the athletes. There was a 100% response from the questionnaire. In total, 216 questionnaires were completed. All injuries reported concerned sporting injuries and not those related to overuse syndromes. Nicholas and Hershman (1990), state that sport injury is an acute musculoskeletal injury, related to an accident which happened in scheduled matches or training sessions and which results in the absence of a player from at least one match or training session.

In the present study handball players were asked to complete a self reported questionnaire. Therefore an issue can be raised regarding its reproducibility. It should be underlined however that none of the examined scientific articles examined the reproducibility of the administered questionnaire. It is possible that the contradicted results which are frequently found in the literature regarding sport injuries stems from instruments' low reproducibility. Futures studies should attempt to clarify this issue. Taking into account the above consideration the results of the present study should be interpreted with some caution.

#### *Statistical Analysis*

In the analysis of the data, the mean was taken, the standard deviation, the frequency of the values of each variable and their percentage. The relationship between the incidence and severity of an injury with all the other variables was studied with the statistical test  $\chi^2$ . The level of significance was determined at .05. In the cases where the relationship between two ordinal variables were examined, Kendall's tau-b test was used.

## **RESULTS**

From the statistical analysis of the findings concerning the players' personal characteristics the average age was estimated at  $22.7 \pm 5.02$  years. The average height was estimated at  $182.5 \text{ cm} \pm 9.54 \text{ cm}$  and weight at  $83 \text{ kg} \pm 11.01 \text{ kg}$ . The average training age was at  $9.1 \pm 5.06$  years, with  $3.7 \pm 1.85$  trainings times per week.

The majority of players 96.3% executed warm up exercises for the total number of team handball players. In the A1, A2-B division and local championship the percentage was (95.8%), (95.8%) and (97.2%) respectively. The use of prophylactic equipment was (38.9%) for the total number of the players. The prophylactic equipment referred only on knee pads, knee sleeves and bandaging. This prophylactic equipment was used exclusively for the protection of the joints and not for rehabilitation or treatment reasons. Moreover none of these players had insufficiency or was on rehabilitation or treatment stage. In the A1, A2-B division and local championship the percentage was (41.7%), (34.7%) and (40.3%) respectively. Stretching exercises executed in two ways: at warm up period and after training or games. At warm up period the percentage was (95.8%) for A1, (95.8%) for A2-B division and (97.2%) for local championship. The total number for all three categories was estimated at (96.3%). After training or games the percentage was (69.4%) for A1, (59.7%) for A2-B division and (36.1%) for local championship. The total number for all three categories was estimated at (55.1%). The majority of players (89.8%) reported the use of technical training (%) in all three levels. In the A1, A2-B division and local championship the percentage was (77.8%), (98.6%) and (93.1%) respectively.

Our findings also revealed a high incidence of injuries for the total number of team handball players. Ninety-two (92) out of the 216 players, (42.6%) had to have treatment for at least one injury during the previous two years (figure 1). In the A1, A2-B division and local championship the percentage was (52.8%), (44.4%) and (30.6%) respectively. With regard to the severity the injuries diagnosed by a specialist, (64.2%) were serious to severe (45.7% were serious and 18.5% were severe) (figure 2). Further, the percentage of players who had to be hospitalized was (19.6%).

Figure 1 about here

Figure 2 about here

The large majority of those injured (77.2%) had one injury, followed by (17.4%) with two injuries, while (5.4%) had over two injuries. (37%) of the handball players reported being injured at the same place where they had sustained a previous injury. The localization of injuries was (59.8%) in the lower limbs, (31.5%) in the upper limbs and (8.7%) to the torso. Most injuries were reported to have occurred during matches (63%), while the remaining (37%) during training. Lastly, quite a considerable percentage (24.2%) of team handball players at a later time had a recurrence of the injury referred to. Furtherstill, our findings revealed that the surface where injuries occurred most was made by wood (72.8%). Moreover the majority of the soles of the player's shoes when injuries occurred were appropriate (shoes especially for handball) (84.8%). Furthermore the playfield characteristics where injuries occurred were closed and capacious (58.7%).

#### *Correlation Analysis*

Incidence of Injuries: There is a correlation between the level of team handball players and injuries ( $\chi^2_{(2)} = 7.42$ ,  $p = .024$ ) More specifically, in Figure 3 it is shown that, the higher the players' level, the greater the number of injuries.

Figure 3 about here

There is a correlation between the number of injuries and past injuries ( $\chi^2_{(2)} = 14.07$ ,  $p = .001$ ). More specifically, in Figure 4 it is shown that, the higher the number of past injuries, the higher the number of injuries.

Figure 4 about here

There is a correlation between the number of injuries and the localization of an injury ( $\chi^2_{(4)} = 13.88$ ,  $p = .008$ ). More specifically, in Figure 5 it is shown that, the higher the number of injuries, the more injuries occur to the upper limbs.

Figure 5 about here

Severity of Injuries: There is a correlation between the number of team handball players who had to be hospitalized and severity of injuries ( $\chi^2_{(3)}=15.25$ ,  $p=.002$ ). More specifically, in Figure 6 it is shown that, the higher the number of team handball players who had to be hospitalized the greater the severity of injuries.

Figure 6 about here

Competition division: There is a correlation between the number of injuries and the time of an injury, (that is, during training or at a match). More specifically, in Figure 7 it is shown that, at the local division, the majority of injuries were reported during matches (86%). On the contrary, at A1 and A2-B division, there is no difference between the percentage of injuries during a match and during training (figure 7).

Figure 7 about here

Recurrence of Injuries: There is a correlation between past injuries and a recurrence of those injuries ( $\chi^2_{(1)}=6.54$ ,  $p=.011$ ). More specifically, in Figure 8 it is shown that, the existence of previous injuries induces a recurrence of those injuries.

Figure 8 about here

There was no correlation between the incidence and severity of injuries with the warm up exercises, the prophylactic equipment, the stretching exercises and the technical training, the surface of the field, the soles of the players' shoes or the place where injuries occurred.

## DISCUSSION

The data on the personal characteristics of the sample used indicate that the majority of Greek handball players were young adults, with a fair amount of previous sports experience. These players participated actively and frequently and had a strong commitment to their team. Additionally they represented all competition levels in Greek team handball and frequently participated in championships.

The results of the present study revealed that the incidence of injuries was high. Furthermore, the severity of these injuries was serious and lead a significant percentage to hospitalization. These results are confirmed by the findings of previous research studies (Biener and Fasler, 1978; Myclebust, Maehlum, Engebretsen, Strand and Solheim, 1997; Wolf et al., 1974), and indicates that in Greece there is a high degree of danger for all three levels in team handball. It is important to state that (37%) of the players reported having an injury at the exact location of a previous injury. This is probably due to the fact that in team handball most of the time, the location of an injury is specific. Until now, no injury pattern for a team handball player has been made, while this has been done for other sports (Kujala, Heinson, Lehto, Bergfeld and Jarvinen, 1988; Luckstead, Satran, and Patel, 2002). From our findings it appears that injuries to the lower limbs, were the most frequent, which are in accord with other research (Andren-Sandberg, 1994; De Loes, Dahlstedt and Thomee, 2000; De Loes & Goldie, 1988). Injuries to the lower limbs occur more often due to the dynamic, rapid, sudden and unexpected movements and jumps of players which place a lot of strain on the lower limbs (Bencke, Naesborg, Simonsen and Klausen, 2000; Biener and Fasler, 1978; Bradford, 2000).

In our results the majority of injuries happened during a game and this result also is in accord with other previous research (Myclebust, Maehlum, Holm and Bahr, 1998; Retting, 1998; Seil, Rupp, Tempelhof and Kohn, 1997). An explanation for this might be that during the game the players try to reach a level of high performance which is much more intense than during training, thus increasing the danger of injury.

Concerning correlation analysis our results are in accord with those of previous studies which showed that the higher the players' level, the greater the number of injuries. From this fact it can be seen that as competition increases, the demands of the game change and the dynamism of the players also increases. With regard to correlation between previous injuries and number of injuries we conclude that the higher the number of previous injuries, the more injuries will occur. For this reason, someone who has had previous injuries has a greater risk of sustaining a new injury in the future. Regarding correlation between number of injuries and localization of injuries, it seems that the higher the number of injuries, the more injuries occur to the upper limbs. This means that an athlete who has had more than one injury, is more likely to also sustain an injury in the upper limbs. It is advisable for players in this situation, to pay particular attention and take specific measures in order to protect their upper limbs. Regarding correlation between the number of team handball players who had to be hospitalized and severity of injuries, it seems that the greater the severity of injuries, the higher the potential hospitalization. Correlation between the number of injuries and the time of an injury, (that is, during training or at a match), revealed that at the local division, the majority of injuries were reported during matches. On the contrary, at A1 and A2-B division, there is no difference between the percentage of injuries during a match or during training. In addition the injury incidence for the A1, A2 – B and local division was 0.96, 1.02 and 1.44 per 1000 hours of exposure time respectively. The reason for this might be because, teams at the local division do not train as regularly or as hard which means that the players have not been properly prepared. Furthermore, in this division the players tend to participate more often in the actual matches rather than go to the training sessions, which results in more physical strain occurring during a match which in turn leads to a high frequency of injuries. Concerning the recurrence of an injury our findings are in accord with those of Nielsen and Yde (1988), who found the same percentage (32%). From correlation of the two variables, it seems that the existence

of previous injuries greatly enhances the risk of their recurrence. For this reason a handball player who has had previous injuries must be very careful and take protective measures to avoid a possible recurrence of these injuries in the future. Behrman, Kliegman and Jenson (2000), state that if someone is injured they must undergo complete rehabilitation and avoid an early return to their previous sporting activity. Lynch and Renstrom (1999), report that an early return after an injury can lead to a recurrence, resulting in the development of a chronic problem which is obviously more difficult to treat. Moreover, Aronen (1991), and Ehrich and Gebel (1992), claim that it must become part of the consciousness of all players who suffer from an injury to return to their previous sporting activity only after a complete and suitable rehabilitation programme and that it is imperative that they observe the time needed for rehabilitation.

In conclusion, it has been ascertained that team handball belongs to the category of high risk sports due to the incidence and severity of injuries. Moreover the incidence of injuries in Greece is similar with other countries. Factors which are related to the incidence and severity are localization, hospitalization, time and recurrence of injuries, the competitive level of the players, previous injuries, as well as the competition division. Further research on injuries and the risk factors involved is necessary, in order to formulate preventive, treatment and rehabilitation measures. Therefore more studies are necessary to provide information to aid in developing appropriate injury pattern and strategies for preventing injuries in team handball.

## TABLES/FIGURES

### Figure legends

Figure 1. Injuries in the last 2 years.

Figure 2. Severity of injuries.

Figure 3. Correlation of Players' Level of Performance and Number of Injuries.

Figure 4. Correlation of Past Injuries and Number of Injuries.

Figure 5. Correlation of Number of Injuries and Localization of Injuries.

Figure 6. Correlation of Number of Hospitalization and Severity of Injuries.

Figure 7. Correlation of Number of Injuries and the time of an injury, (ie. during training or at a match).

Figure 8. Cross correlation between previous injuries and recurrence of injuries.

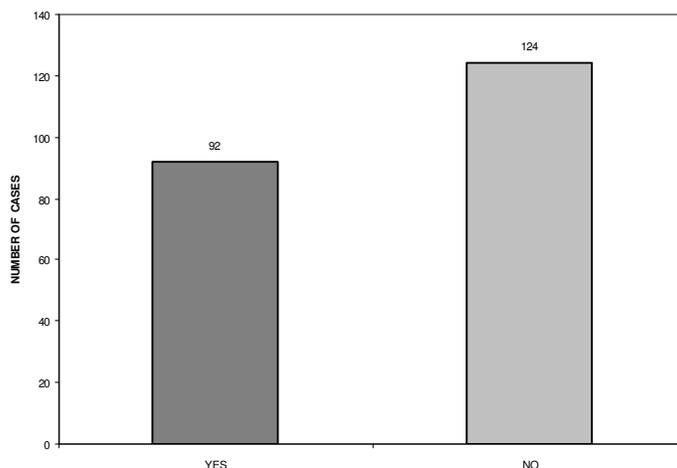


Figure 1.

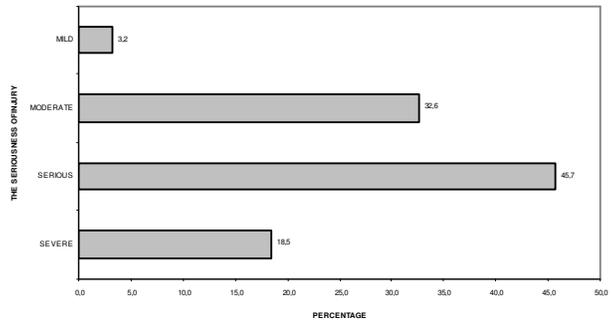


Figure 2.

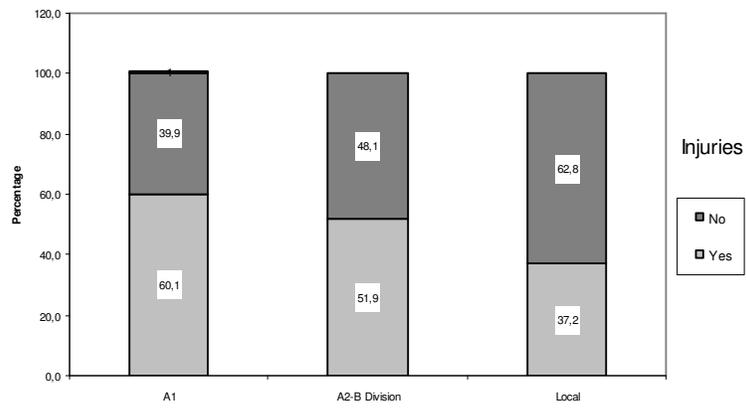


Figure 3.

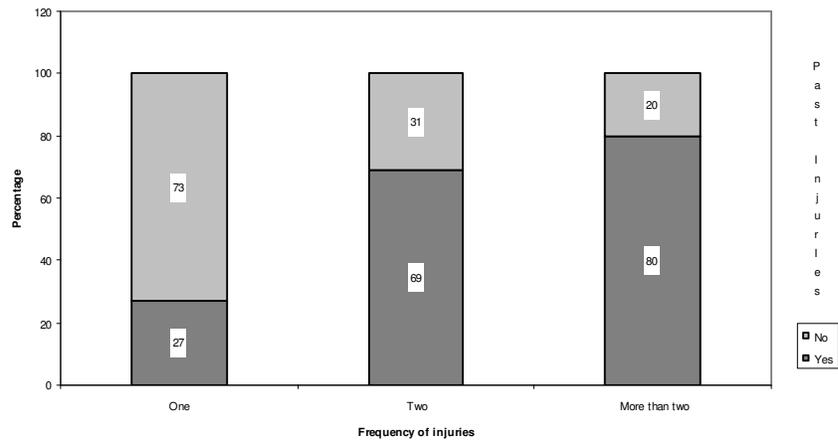


Figure 4.

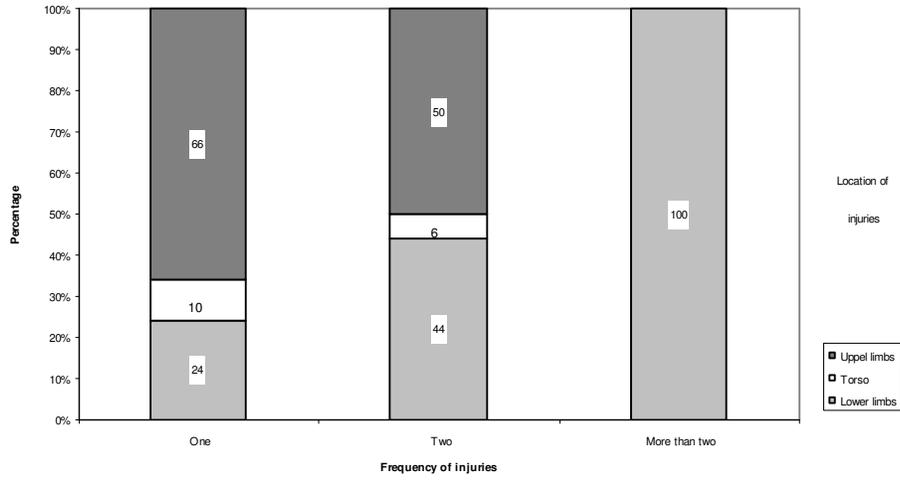


Figure 5.

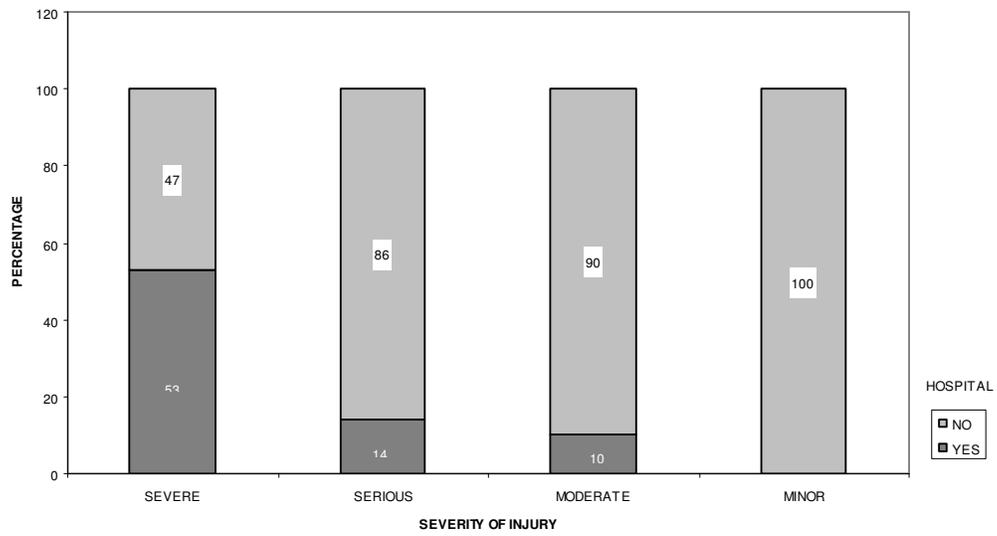


Figure 6.

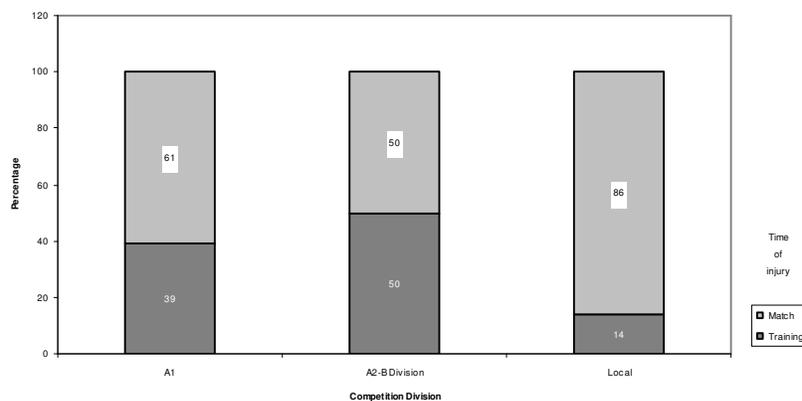


Figure 7.

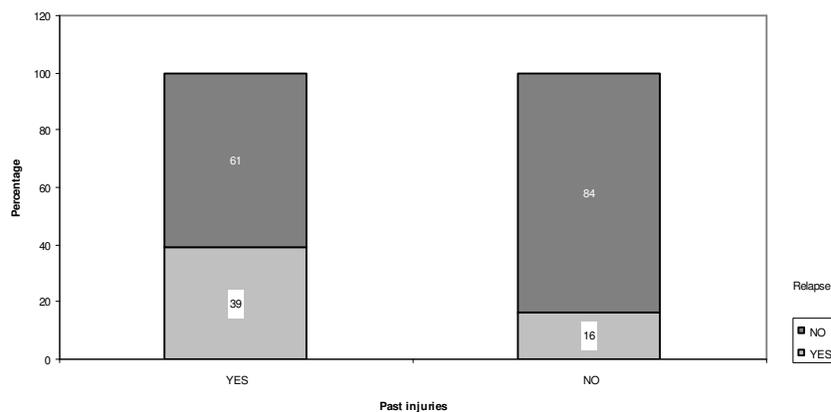


Figure 8.

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