Original Article (short paper)

Analysis of recall bias of information on soccer injuries in adolescents

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Abstract — Aims: to analyze the recall bias of injury characteristics, anthropometric variables, and training variables in a morbidity survey in adolescent soccer players for a period of four months. **Method:** cohort study with 198 adolescent male soccer players, divided into two parts: a prospective study over four months, followed by a retrospective study. A morbidity survey containing personal and training data, in addition to information on injuries and their characteristics (anatomical site, mechanism, nature, moment, severity, return to activities and recurrence) was administered weekly for four months, after which the questionnaire was applied again questioning the same information retrospectively for the four-month prospective study period. The data were collected through interviews addressing the occurrence of injuries and respective characteristics. **Results:** there were weak correlations and concordances for the recall of the occurrence of injury and all related variables. However, regarding the information relating to personal and training data, moderate correlations were observed for the variables height, time of training, weekly hours, absences, and position, as well as excellent correlations for body mass. **Conclusions:** we observed recall bias in all information about the characteristics of the injuries reported by adolescent soccer players.

Keywords: questionnaires, traumatism in athletes, adolescent.

Introduction

The registration of sports injuries is performed in some countries by specialized associations, aiming to control and better understand the possible causes. This model, associated with a prospective follow-up, may be an interesting option for studying the association between cause and effect. However, in many countries there are no specific recording systems, especially for adolescents who are beginning to practice sports, and, therefore, other methods are used to identify epidemiological data, such as surveys of reported morbidity[1-8].

Surveys of reported morbidity are considered effective tools for population analysis, in addition to being low cost; they do not require clinical assessment or tests and cover much of the information necessary for epidemiological studies on injuries[9,10]. However, when there is a time interval between the occurrence of the injury and its recording, there can be loss of information.

Soccer has been the focus of studies in various fields and the high number of practitioners worldwide makes the understanding of injuries in this sport a scenario of interest for everyone involved. Some studies, to minimize recall bias, have used prospective designs and are assisted by surveillance systems of injuries[11,12], with monitoring by health professionals[13,14]. However, there are still studies with retrospective designs[15,16].

The models cited have been used as options in the absence of systematic control registers. The best possible model is required to ensure accurate information, particularly considering the difficulty in accessing the target population[7,8] and more specifically considering beginner practices of sports. However, does the search for information in this profile result in reliable information? Our hypothesis is that recall bias is low and beginner players can recall the characteristics of the injury requiring fewer details.

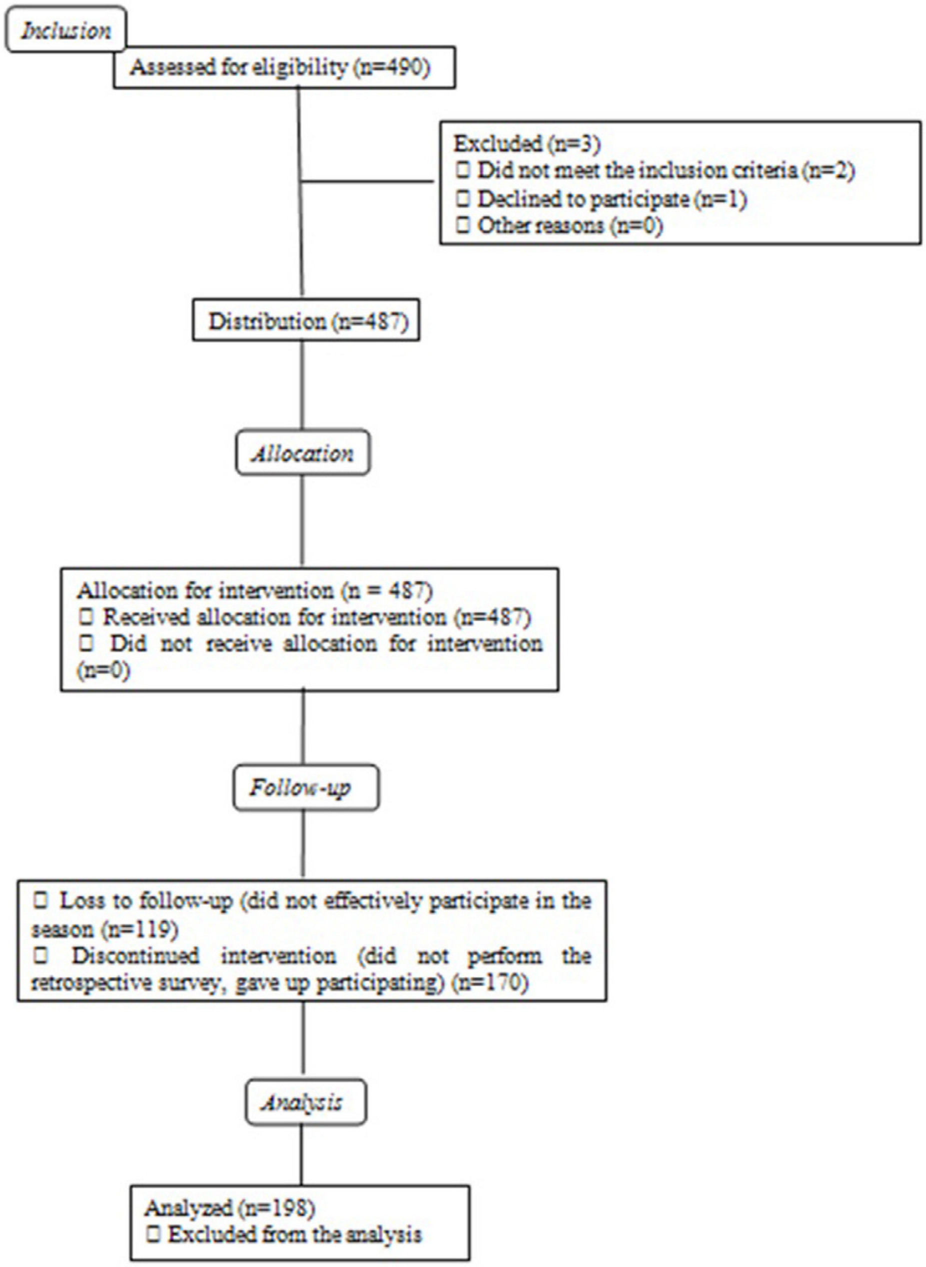
Thus, the objective of this study was to analyze the recall bias of injury characteristics, anthropometric variables, and training variables using a morbidity survey in adolescent soccer players over a period of four months.

Methods

For this study, data from adolescent male soccer players were analyzed. For the composition of the sample, the registration of the adolescents, practitioners of this sports modality, was considered, as offered by the Municipal Secretary of Sports of Presidente Prudente, state of São Paulo. The total eligible population consisted of 490 volunteers who were properly enrolled and frequent in training. Two did not comply with one of the inclusion criteria (aged over 18 years) and one volunteer did not agree to participate in the study, thus, a total of 487 adolescents were evaluated during the intervention. Throughout the study, 119 adolescents did not demonstrate regular training frequency and 170 adolescents stopped training and did not perform the retrospective survey, thus, the final study analysis consisted of 198 adolescents (Figure 1).

All volunteers were informed about the procedures and objectives of the study and, after agreeing, signed an informed consent form. The study was approved by the Research Ethics Committee of the Universidade Estadual Paulista – FCT/UNESP (Protocol: 013130/2012).

Figure 1. Flow diagram representation of the participants.



This was a cohort study, divided into two parts: a prospective study followed by a retrospective study. In the prospective design, the volunteers were followed over a period of four months, during which they were asked weekly about the occurrence of sports injuries, whilst training and/or competing in addition to absences from training. If there were sports injuries, the characteristics of the injuries were recorded in the survey. This survey was developed to collect information about sports injuries and variables related to them, based on studies by Pastre, Carvalho Filho, Monteiro, Netto Júnior, Padovani[2] and Fuller et al.[17].

After one week of conclusion of the prospective design, all adolescents were questioned again with a morbidity survey about all the injuries that had occurred during the four-month prospective study, comprising the retrospective design. In this sense, the morbidity survey was used to examine the recall bias of the issues related to sports injuries.

Initially, a pilot study was performed to adjust the procedure for data collection and test the applicability of this instrument in the target population. The data were collected in the form of an interview, carried out by two interviewers familiar with the instrument, who read the questions, explained each topic to the adolescents and annotated the responses in individual records. This procedure was suggested by Pastre, Carvalho Filho, Monteiro, Netto Júnior, Padovani[2] in their study, based on different levels of understanding for annotation of responses by the respondents themselves.

In addition to information on sports injuries, the collection of anthropometric variables (mass and height) and training variables (training time, weekly hours of training, and position) based on the morbidity survey were also carried out at two moments, initially and after four months. To avoid interfering in the dynamics and routines of the regular sports training, the volunteers were approached before or after the training sessions.

Sports injuries in this study were defined as any physical complaint resulting from training and/or competitions that limited the participation of the individual for at least one day, regardless of the need for medical attention[1,9,16] and/or occurrence of symptoms responsible for changes in the form, intensity, volume or frequency of training, without it necessarily having to be interrupted[18].

The morbidity survey contained, in addition to information on sports injuries, personal data and training data on the volunteers, such as age, dominant limbs, height, body mass, body mass index calculated by the evaluator, player's position, duration of training, training hours per week and number of days that the respondent missed training.

Regarding anthropometric variables, we chose to investigate whether the volunteer could respond appropriately to measurements of body mass and height. To evaluate this, firstly, the volunteer was asked about his anthropometric measurements, after which, the researcher performed the same measurements, which, however, were not disclosed to the volunteers to verify the agreement between the actual measurements and the information reported, both in the prospective design and retrospective survey.

For the assessment of body mass, a digital scale BC554 Aeroman/Inner Scanner (Tanita, Illinois, USA) was used, while to measure height, a portable stadiometer Sanny (American Medical do Brazil, São Paulo, Brazil) was used. The adolescents were barefoot and wearing light clothing during the measurements.

To obtain information concerning sports injuries, the morbidity survey contained questions about anatomic site affected, mechanism of injury, nature of injury, moment of injury, severity of injury, return to normal physical activity, and recurrence.

Regarding the anatomic site, related to the symptom of pain or discomfort reported by the volunteers, the questionnaire presented 20 body regions (upper limb [shoulder, arm, elbow, forearm, wrist, and hand], lower limbs [anterior thigh, posterior thigh, knee, leg, calf, ankle and foot], and trunk [thorax, abdomen, head, cervical spine, lumbar spine, pelvic waist, and others]) and an illustrative figure of the human body with the questionnaire to facilitate the identification of the exact site of injury.

Regarding the mechanism that caused the injury, the following categories were considered: i) direct contact with another player; ii) direct contact with the ball; iii) other direct contact (object or ground) and; iv) non-contact[17]. Direct contact injuries were those caused by a single traumatic incident such as a collision against an opponent or a fall[14,18]. Non-contact injuries are those inherent to the sport itself, such as racing long and short distances, quick changes of movement, jumping, landing, among others[14].

The nature of the sports injury was considered as the dynamics of the actions of the practitioner at the moment of injury and were divided into three situations: i) physical training; ii) training game, and iii) competition game. Considering the possibilities of attention during dynamic practice, the moment of injury was also explored: i) the outset/first third of training or a game, ii) the middle/second third of training or a game, and iii) the end/final third of training or a game.

The information on the severity of the injury was defined according to Fuller et al.[17], who ranked sports injuries according to time out from the sport to recover, divided into four grades: minimal (one to three days off), mild (four to seven days off), moderate (eight to 28 days off), and severe (greater than 28 days off or permanent injury).

The return to normal physical activities aimed to observe whether the return to the sport without any changes in training occurred with or without the presence of signs and/or symptoms of the injury. Finally, recurrence details were collected to detect whether such an occurrence had already manifested itself on other occasions and in the same anatomical site after the return of the athlete to normal activities[14].

Descriptive statistics were used to analyze the profile of the population and describe the variables. The concordance between the responses of the athletes at both collection periods, considering qualitative variables, was performed using constant confidence interval (CI) for the proportion of concordance, with values above 50% termed as significant concordance and values below 50% as significant discordance[19]. The Kappa test was also used, wherein the coefficients of 0.81 to 1.00 were considered as very good; 0.60 to 0.79, good; 0.40 to 0.59, moderate; 0.20 to 0.39, weak; and 0.0 to 0.19, poor[20].

For the quantitative variables, the intraclass correlation coefficient was used, comparing the reported measurements with the actual measurements taken in the prospective and retrospective designs. Values smaller than 0.5, between 0.5 and 0.75, between 0.75 and 0.9, and greater than 0.90 are indicative of poor, moderate, good, and excellent reliability, respectively[21]. For all comparisons, a 95% level of confidence was adopted.

Results

The adolescents presented a mean age of 13.48 ± 1.34 years, height of 1.61 ± 0.10 meters, body mass of 50.22 ± 12.25 kg, and body mass index of 19.15 ± 3.18 kg/m².

The values of the distribution of injury occurrences and related variables are presented in Table 1. We observed weak concordance for all variables. In the prospective design, of the total of 219 occurrences, 21 were reports of athletes who had had more than one injury. It is noteworthy that of the total of 40 injuries reported in the retrospective design, only 29 injuries were remembered, being that the remainder (11 reports) had not been reported in the prospective design.

Table 1. Distribution of cases n (%), followed by the percentage of concordance and concordance interval and the value of Cohen's Kappa concordance test for prospective and retrospective answers according to the occurrence of injury, anatomical site affected, mechanism of injury, nature of injury, moment of injury, severity of injury, return to normal activities, and recurrences.

Variable	Study Design		Statistics
	Prospective	Retrospective	Concordance % (CI% [Kappa]
Injury			
Reported	64 (29.22)	40 (18.26)	38.6 (26.4 – 28.3)
Not Reported	155 (70.78)	179 (81.74)	[0.28]
Anatomical site			
Shoulder	1 (1.56)	1 (1.56)	
Hand	2 (3.13)	2 (3.13)	
Anterior thigh	6 (9.38)	3 (4.69)	
Posterior thigh	5 (7.81)	3 (4.69)	
Knee	13 (20.31)	4 (6.25)	
Leg	2 (3.13)	0 (0.00)	
Calf	1 (1.56)	0 (0.00)	
Ankle	16 (25.00)	6 (9.38)	37.3 (26.4 – 28.3)
Foot	10 (15.63)	6 (9.38)	[0.28]
Chest	1 (1.56)	0 (0.00)	
Abdomen	1 (1.56)	1 (1.56)	
Head	1 (1.56)	0 (0.00)	
Lower back	1 (1.56)	1 (1.56)	
Pelvic girdle	4 (6.25)	1 (1.56)	
Other report [a]	-----	1 (1.56)	
Not recalled	-----	35 (54.68)	
Mechanism of injury			
Direct contact	34 (53.12)	10 (15.62)	
Non-contact	30 (46.88)	15 (23.44)	33.3 (22.6 – 44.0)
Other report [a]	-----	4 (6.25)	[0.31]
Not recalled	-----	35 (54.68)	
Nature of injury			
Physical training	6 (9.38)	0 (0.00)	
Training Game	54 (84.37)	25 (39.06)	
Competition Game	4 (6.25)	0 (0.00)	33.3 (22.6 – 44.0)
Other report [a]	-----	4 (6.25)	[0.29]
Not recalled	-----	35 (54.68)	
Moment of injury			
Outset of training or game	16 (25.00)	3 (4.69)	
Middle of training or game	20 (31.25)	6 (9.38)	
End of training or game	28 (43.75)	12 (18.75)	28 (17.8 – 28.2)
Other report [a]	-----	8 (12.50)	[0.30]
Not recalled	-----	35 (54.68)	
Severity of injury			
Without absence	42 (65.63)	17 (26.56)	
Minimum	14 (21.87)	4 (6.25)	
Mild	4 (6.25)	2 (3.13)	
Moderate	3 (4.69)	2 (3.13)	34.6 (24.1 – 25.3)
Severe	1 (1.56)	1 (1.56)	[0.29]
Other report [a]	-----	3 (4.69)	
Not recalled	-----	35 (54.68)	
Return to normal activities			
Asymptomatic	20 (31.25)	9 (14.06)	
Symptomatic	44 (68.75)	15 (23.44)	32.0 (21.4 – 42.5)
Other report [a]	-----	5 (7.81)	[0.29]
Not recalled	-----	35 (54.68)	
Recurrences			
Yes	24 (37.50)	6 (9.38)	
No	40 (62.50)	16 (25.00)	29.3 (19.1 – 29.6)
Other report [a]	-----	7 (10.94)	[0.30]
Not recalled	-----	35 (54.68)	

[a] Report divergent between prospective and retrospective designs.

Table 2 shows the correlation between the measurements reported by the athlete and the values measured by the evaluator, both in the prospective and retrospective designs. There was moderate correlation for height and excellen correlation for body mass.

Table 2. Correlation between reported and measured measurements for height and body mass.

Variable	Study Design	
	Prospective	Retrospective
Body mass	0.93 (0.91 – 0.95)	0.92 (0.90 – 0.94)
Height	0.56 (0.47 – 0.65)	0.62 (0.53 – 0.69)

Intraclass correlation coefficient and confidence interval values presented.

We observed moderate correlation in the responses of athletes regarding training time, weekly hours, and absences from training, as shown in Table 3.

Table 3. Correlation between the answers on training time, hours per week, and reported absences in the prospective and retrospective study designs

Training time	0.59 (0.50 – 0.68)
Hours per week	0.53 (0.43 – 0.62)
Absences	0.56 (0.46 – 0.64)

Intraclass correlation coefficient and confidence interval values reported.

The players' position variables are presented in Table 4. There was a significant agreement of 72.2%, with k = 0.70 demonstrating good concordance.

Table 4. Distribution of cases n (%), followed by the percentage of concordance and concordance interval and the value of Cohen's Kappa concordance test between answers on position of the player, in the prospective and retrospective study designs.

Position of the player	Study Design	
	Prospective	Retrospective
Goalkeeper	9 (4.11)	9 (4.11)
Right attacking midfielder	13 (5.93)	10 (4,57)
Left attacking midfielder	7 (3.20)	6 (2.74)
Back	42 (19.18)	34 (15.53)
Striker	65 (29.68)	53 (24.20)
Midfielder	20 (9.13)	7 (3.20)
Right-back	27 (12.33)	15 (6.85)
Left-back	7 (3.20)	5 (2.28)
Defensive midfielder	21 (9.59)	14 (6.39)
Center forward	1 (0.46)	1 (0.46)
Right wing	5 (2.28)	2 (0.91)
Left wing	2 (0.91)	2 (0.91)
Another position	-----	61 (27.85)

Geral Concordance % (IC%): 72.2 (66.3 – 78.1)
Kappa: 0.70

Discussion

This study analyzed the recall bias for a period of four months in adolescent soccer players. We observed that there was weak concordance between the prospective and retrospective reports, as well as weak concordance between the occurrence of the injury and its variables. Despite morbidity surveys being effective for population analysis, epidemiological studies, and in high athletic performance[2], for a population of adolescent beginners in sports, it does not seem to be the best strategy for identifying injuries after a recall period of four months.

In this sense, we hypothesize that the possible causes to be raised for recall bias are: own recall bias, i.e., the athletes cannot remember their injuries properly; wrong or false reporting due to the inability of the adolescents to understand and report the occurrence of a sports injury, and/or possible transient or irregular characteristic of the symptoms.

In the literature, retrospective self-reporting of sports injuries was validated in one week[22], however, the trend observed was that the longer time to recall and the complexities of the reported information increased the chances of discordance and recall bias[23,24]. However, the findings of this study showed that weak concordance remained in approximate values, regardless of the complexity of the reported variable.

Regarding the occurrence of sports injuries, we observed that most (65.6%) injuries were classified as "any physical complaint that changed the intensity, volume or frequency, without any interruption"[25]. For the population studied, the injuries did not seem to be serious and even when classified according to days of absence, most were considered mild, with a maximum of one to three days of absence.

Other studies[18,26] have observed that for the age group of 14 years old, injuries present higher risk when compared with the population between 15 and 18 years old. In this study, the mean age was 13.48 ± 1.34 years. For this age group, the injuries are usually characterized by a few days of absence of the athlete from the sport[18,26,27] and if the injuries have irregular characteristics, recall bias may be a result of faster recovery, thus making the recall less relevant for the athletes.

Regarding the analysis of the variables of injuries separately, ankle, knee and foot, respectively, were the anatomic sites that presented higher incidence, confirming the findings of other studies[15,26,28]. However, the proportion recorded for the foot was higher compared to the ankle and knee. In a study by Oztekin, Boya, Ozcan, Zeren, Pinar[29], it was found that of a total of 200 individuals with soccer related injuries in the lower limbs, 66 (33%) had severe injuries to the ankle and foot.

When analyzing the most common type of injuries in football, the majority are classified as bruises and strains[15,17,30]. It is likely that the recall of an injury is directly related to the type of injury and, consequently, with the severity of this injury, which leads to more days out of the sport for the athlete and deprivation of the normal activities. We should also consider that foot injuries can cause more losses to activities performed daily, thus making them easier to remember.

For the mechanism of injury, the prospective design presented increased reports for injuries through direct contact; however, there were more reports of non-contact injuries. Injuries caused by direct contact are often described in the literature[15], and it is likely that athletes forget them more easily, as they often result in light injuries and are normal consequences of the game dynamics.

Concerning the nature of the injury, the highest number of injuries occurred during training games, with more recalls happening in this area. This result seems to be directly connected to the greater exposure of players to training regarding competitions. For the moment of injury, there were more reports and a higher proportion of recalls for the final third of the game/training. In fact, during this period there is evidence that the greater number of injuries may be related to fatigue[27], and consequently the reports of recall were more evident because they were associated with athletes feeling tired.

Concerning recurrence, for both the prospective and retrospective designs, the prevalence was absence of recurrence. However, when there was a return to normal activities by these athletes, in the follow-up of the study, the injuries appeared more frequently with the presence of symptoms, and in the proportion of recall, these values are more significant for asymptomatic returns. What could justify such a finding is the possibility that the first appearance of the injuries can be more easily recalled or evidenced by the athletes.

Generally, the injuries with smaller proportions of recall were characterized as: being of direct contact; happening during physical training or competitions; presenting symptomatology after the return of the athlete; being recurrent; and being of minimum severity. The recall of injuries in adolescents seems to become more evident: as the variables are simplified; when there is a single episode; and when the severity of the injury is high. In addition, information that reflects the characteristic of the individual, such as anthropometric data and training data, generally, show good concordance.

From the above, we understand that retrospective studies should be viewed with caution for populations of the same nature, for even over shorter periods of time, there is a chance of weak concordance of self reports by adolescents on the occurrences of injuries and their variables.

As a limitation of the study, the low number of injuries stands out as comparisons are weakened when stratifying them for more specific interpretation, considering typology and situational causes. The investigation of socioeconomic status, which was not considered in this study, could also deepen discussions on the topic.

The impact of this study concerns the attention when conducting research on sports injuries in populations of the same nature, both when analyzing retrospectively and prospectively. As a perspective, we highlight the need for measuring bias in the interstice of time from three weeks to four months for the recall of injuries, considering the difficulty regarding access and existence of clinical records and medical staff.

Conclusion

We conclude that there was recall bias of information on the occurrence of injuries, as well as on their characteristics (anatomical site, mechanism, nature, moment, severity, return to normal activities, and recurrences) in adolescent players of soccer for a period of four months. However, when the information was related to personal and training data, the concordances were considered excellent for body mass and moderate for height, training time, weekly hours, and absences from training.

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