

## Epidemiological profile of soccer-related injuries in a state Brazilian championship: An observational study of 2014–15 season



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### ABSTRACT

**Background:** Soccer related injuries are often reported in studies, but epidemiological research on this theme is rare in Brazil. Furthermore, the conditions in which athletes have returned to sports practice, namely, either symptomatic or asymptomatic, have been neglected in research.

**Objectives:** The aim of this study was to describe the epidemiological features of injuries among professional Brazilian soccer players in relation to location, type, mechanism, severity, recurrence, treatment and, lastly, symptoms in return to sport.

**Study design:** Descriptive and cross-sectional, observational study.

**Study center:** School of Physical Therapy of the University of Mato Grosso do Sul, Brazil.

**Methods:** 116 male professional athletes of teams from a Brazilian state championship were interviewed and information about injuries was recorded using a retrospective reported morbidity questionnaire. Data were analyzed in mean  $\pm$  SD for physical characteristics and sports practice history in absolute and relative frequencies (chi-square test with Bonferroni's correction) for characterization of soccer injuries in terms of type, location, severity, recurrence and symptoms in return to sport.

**Results:** The numbers of injuries per athlete and per injured athlete were 0.92 and 1.43 respectively. The injuries of muscle-tendon unit and the joint types localized on lower limbs constituted the most important clinical occurrences with significant difference both in relation to other types ( $p < 0.05$ ). Moderate and severe injuries were the most frequent occurrences. In relation to mechanisms for each type of injury, body contact was at least three times more responsible for injury cases. This type of mechanism was associated with a significantly greater impairment of joint structures. Concerning occurrence and recurrence of cases, the number of recurrent injuries of the muscle-tendon unit reached about 7.5% of the first-time injuries, while the number of joint recurrent injuries integrated almost 40% of the first-time cases. Significant differences between first-time injuries and recurrent injuries were found only for muscle-tendon and joint structures ( $p < 0.05$ ), while significant differences among the type of injuries within each type of occurrence (first-time or recurrent injuries) were also found between muscle-tendon and joint injuries ( $p < 0.05$ ). In relation to athletes with symptoms, in return to sport, 77.6% of them were treated for their injuries but more than half of them returned with symptoms still present when compared to those who returned without any symptoms. Among athletes who did not receive treatment, a lower percentage (58.3%) returned to the sport with symptoms still present. Significant associations between treatment and symptomatology were not found.

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### 1. Introduction

From the cultural point of view, soccer is the most played sport in the world with over 270 million practitioners<sup>1</sup> and although it is an intermittent demand sport style in terms of intensity, its practice is characterized by high-intensity efforts and repetition of

specific gestures and techniques, resulting in a high incidence of injuries.<sup>2</sup>

In this perspective, several studies have investigated the epidemiology of injuries in soccer. However, the results are inconsistent and difficult to compare due to a great variation in methods used to record the injuries, period in which the injury occurred and sample characteristics, which include differences in athletes' ages and level.

For example, there are epidemiological descriptive studies, either retrospective<sup>3</sup> or prospective cohort,<sup>4</sup> considering amateur,<sup>5</sup> professional<sup>2</sup> and elite<sup>6</sup> players in relation to injuries occurred in different periods as pre-season, training and competition.<sup>7</sup>

In Brazil, country with 30 million practitioners, studies on this issue are scarce but essential to provide information for professionals responsible for the rehabilitation of athletes, so they can implement preventive strategies based on knowledge of the epidemiological characteristics of the injuries. However, besides the methodology problems previously mentioned, an aggravating factor in these studies is related to the sample that is frequently small,<sup>8</sup> stemmed from either a few teams or even a single one<sup>9</sup>, composed of amateur athletes<sup>10</sup> for whom the demands of physical effort are admittedly smaller and having larger recovery periods.

Finally, it is of special interest to coaching and medical staff responsible for the physical conditioning and rehabilitation of athletes to know the conditions in which these athletes have returned to sports practice,<sup>11</sup> especially those from clubs with budget constraints, limited physical structure and human resources.

This information, as well as if the return of the athlete to sport was either symptomatic or asymptomatic, has been neglected in research, although it is an important aspect leading to injury.

The aim of this study was to describe the epidemiological features of injuries among professional Brazilian soccer players in relation to location, type, mechanism, severity, recurrence, treatment and, lastly, symptoms in return to sport.

**2. Material and methods**

The present manuscript configures a descriptive, cross-sectional, observational study conducted with 116 male professional athletes of six teams from a regional championship (first division) in the 2014–15 season. The local Ethical Committee (legal opinion number 1.006.805) approved this study. All subjects signed a consent form.

**2.1. Selection criteria**

We included all male athletes with a history of specific, regular and systematic soccer training for at least 12 months with sports competitive purpose. Athletes with injuries acquired outside the context of either competition or training were excluded.

**2.2. Data extraction and synthesis**

The athletes were interviewed and evaluated only once, when their demographic (anthropometry and sports practice) and sports injuries characteristics were recorded.

Information about injuries was recorded using the reported morbidity inquire suggested by Pastre et al<sup>12</sup> This instrument was adapted according with previous studies<sup>13–16</sup> in order to adjust to characteristics of the investigated sport and the target public as follows: injury location (upper limbs, lower limbs, trunk and head-neck); injury type (muscle-tendon, joint, bone and others); mechanism of injury (running, jumping, technical aspect, body contact and others/do not remember). The authors of the present

study also included information about severity and recurrent injury. Existent injuries from total time of soccer's regular practice were considered. Sports injuries due soccer's regular practice during last 18 months (2014–15 season) were considered to catalog results.

Our study followed the consensus on definition of Fuller et al<sup>15</sup> Thus, all injuries resulting in a player being unable to fully engage in training or official match were recorded. The severity was determined based on the concept of the number of lost days, from the date of injury to return to sport (training or match). Injuries were classified as minimal, mild, moderate and severe,<sup>1,15</sup> depending on the days the athlete was absent from play, between 1–3, 4–7, 8–28 and more than 28 days, respectively.<sup>1,15</sup>

If the athlete could not fully participate in the activities on the day of injury, but was available the next day, the injury was classified as minimal.

Recurrent injury was defined as the injury of the same type and on the same body location as a previous injury.<sup>1</sup> The remaining injuries were classified as first-time injuries.

Finally, information about receiving some type of care from the medical staff (physician; physiotherapist; nurse; dentist; emergency care teams) and return to sport (symptomatic; asymptomatic) was also recorded.

Data are presented as means, standard deviations (SD), absolute and relative frequencies according to the case. A chi-square test with Bonferroni's correction was used to detect significant differences when necessary. Significance was set at  $p < 0.05$ . The statistical analysis were performed with SPSS software version 20 (SPSS Inc., Chicago, Illinois).

**3. Results**

During the 2014–15 season, 12 teams participated in a Brazilian state championship, and six of them were selected for the research. All athletes belonging to the six teams were pre-selected to participate in the research. However, after analyzing the inclusion and exclusion criteria, 116 were selected to compose the study sample, with 75 of them with history of injury (64.6%).

The players' physical characteristics and sports practice history (mean  $\pm$  SD) were 24.19  $\pm$  4.27 y, 178.80  $\pm$  6.97 cm, 77.21  $\pm$  8.97 kg, 145.42  $\pm$  57.86 months of training time, while the number of injuries per athlete (I/A) and per injured athlete (I/A+) were 0.92 and 1.43 respectively.

Characterization of sport injuries, in terms of clinical type and anatomical location, is presented in Table 1. In general, injuries of muscle-tendon and joint types localized on different anatomical sites from lower limbs constituted the most important clinical occurrences of the present study.

Concerning the severity, moderate [n = 40] and severe [n = 20] sport injuries were the most frequent occurrences, according to the classification (Table 2). However, significant differences among the different degrees of severity for each type of injury were found only

**Table 1**  
Injuries by location and type.

Type	Location			
	Upper Limbs	Lower Limbs	Trunk	Head-Neck
Muscle-tendon	1 (12.5) <sup>A</sup>	37 (43.5) <sup>A</sup>	4 (66.7)	1 (12.5) <sup>A</sup>
Joint	4 (50.0)	44 (51.8) <sup>a,A</sup>	1 (16.7) <sup>A</sup>	0 (0.0) <sup>b,A</sup>
Bone	3 (37.5) <sup>a,B</sup>	4 (4.7) <sup>b,B</sup>	0 (0.0)	1 (12.5) <sup>A</sup>
Others	0 (0.0) <sup>a,b</sup>	0 (0.0) <sup>b,B</sup>	1 (16.7) <sup>a,c,B</sup>	6 (75.0) <sup>c,B</sup>
Total	8 (100)	85 (100)	6 (100)	8 (100)

Note: 1) different lower case letters indicate significant differences within each row; 2) different capital letters indicate significant differences within each column; 3) values in parentheses show the percentage of the total of each location.

**Table 2**  
Injuries by severity and type.

Type	Severity				
	Slight	Minimal	Mild	Moderate	Severe
Muscle-tendon	7 (38.9)	8 (50.0)	3 (42.8)	18 (45.0)	7 (26.9)
Joint	6 (33.3) <sup>A</sup>	6 (37.5)	2 (28.6)	18 (45.0)	17 (65.4)
Bone	1 (5.6)	1 (6.2)	2 (28.6)	2 (5.0)	2 (7.7)
Others	4 (22.2) <sup>B</sup>	1 (6.2)	0 (0.00)	2 (5.0)	0 (0.00)
Total	18 (100)	16 (100)	7 (100)	40 (100)	26 (100)

Note: 1) different capital letters indicate significant differences within each column; 2) values in parentheses show the percentage of the total of injuries for each degree of severity.

between the joint and the other injuries within the slight severity level.

When we analyze the mechanisms for each type of injury, it is noted that body contact was at least three times more responsible for injury cases ( $n=62$ ) than other mechanisms (Table 3). Furthermore, this type of mechanism was more strongly associated with a significantly greater impairment of joint structures.

Taking into account the proportion of sport injuries concerning the occurrence and recurrence of cases, the number of recurrent injuries of the muscle-tendon unit reached about 7.5% of the first-time injuries, while the number of joint recurrent injuries integrated almost 40% of the first-time cases (Fig. 1). Significant differences between first-time injuries and recurrent injuries were found only for muscle-tendon and joint structures, while significant differences among the type of injuries within each type of occurrence (first-time or recurrent injuries) were found between muscle-tendon and joint injuries.

Lastly, in relation to athletes with symptoms in return to sport, 77.6% of them were treated for their injuries but, surprisingly, among these more than half returned with symptoms still present when compared to those who returned without any symptoms ( $n=50$  [60.2%] vs.  $n=33$  [39.8%]). Among athletes who did not receive treatment, a lower percentage (58.3%) returned to sport with symptoms still present.

Significant associations between treatment and symptomatology were not found ( $p=0.867$ ).

#### 4. Discussion

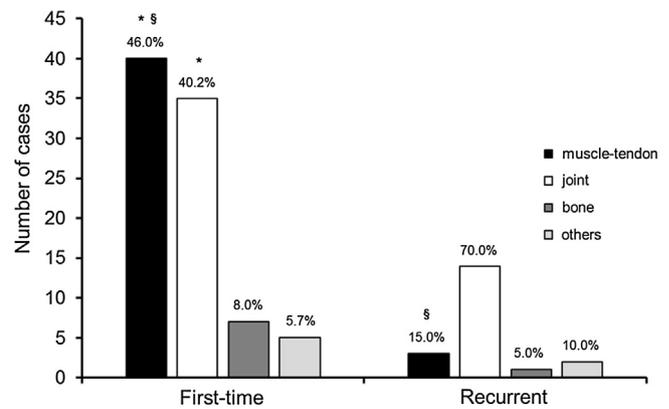
In the first analysis, the lower limbs were the segments with the highest number of injuries, corroborating other studies.<sup>1,5,6,13</sup>

In this study, similar values to Herrero et al<sup>1</sup> were found in relation to the lower limbs (79.4 vs. 69.8%), upper limbs (7.5 vs. 10.7%), trunk (5.6 vs. 10.9%) and head-neck (7.5 vs. 8.6%). In that paper, the studied population was composed of amateur athletes, while in our study professional athletes were included. However, the comparison made with data from professional athletes reveals

**Table 3**  
Injuries by mechanism and type.

Type	Mechanism			
	Running	Jumping	Technical Performance	Body Contact
Muscle-Tendon	14 (87.5) <sup>a,A</sup>	4 (36.4) <sup>b,c</sup>	14 (77.3) <sup>a,c,A</sup>	11 (17.7) <sup>b,A</sup>
Joint	2 (12.5) <sup>a,B</sup>	5 (45.5)	4 (22.7) <sup>a,B</sup>	38 (61.3) <sup>b,B</sup>
Bone	0 (0.00)	1 (9.1)	0 (0.0)	7 (11.3) <sup>A</sup>
Others	0 (0.00)	1 (8.3)	0 (0.0)	6 (9.7) <sup>A</sup>
Total	16 (100)	11 (100)	18 (100)	62 (100)

Note: 1) different lower case letters indicate significant differences within each row; 2) different capital letters indicate significant differences within each column; 3) values in parentheses show the percentage of the total of each mechanism.



**Fig. 1.** Comparison of the first-time injuries and recurrent injuries for the different type recorded. Note: 1) above the bars are the relative frequencies (total was calculated apart for either first-time or recurrent injuries); 2) \* indicates significant difference between first-time and recurrent injury; 3) § indicates significant difference between muscle-tendon and joint injury.

very close values to ours. Shalaj et al,<sup>17</sup> for example, investigating 143 professionals from 11 teams, found that 72% of injuries occurred in the lower limbs.

This predominance of injuries in the lower limbs has been explained by mechanisms subdivided into categories. John et al<sup>11</sup> found that injuries caused by non-contact mechanism in different sports contributed to most injuries (64.4%).

However, analyzing research that exclusively contemplated soccer, the results are in agreement with Ekstrand et al<sup>18</sup> that attribute to body contact, a specific feature of soccer, the high number of injuries in this sport. Pagrazio e Forriol<sup>2</sup> also found more contact than non-contact injuries, 30 vs. 14 respectively.

This divergence between the prevalence of injury by contact or non-contact can be explained by its form of recording. Some researchers use recording of injuries in medical records while others, such as in the present research, use questionnaires applied directly to athletes.<sup>19</sup> Differences in interpretation of the mechanisms of injury made by those who register it and those who suffer the injury may be present. An athlete, who reports having suffered a muscle strain at the time he was reaching the ball, can omit it or not when questioned in details. Thus, a more detailed answer, with the information that, at the moment prior to the ball approach, he was abruptly touched by the opponent, can be neglected. Consequently, an injury caused by body contact can be erroneously recorded as a non-contact injury due to running.

Regarding the other locations, they had similar prevalence. This same result, which was found in a previous study<sup>1</sup>, reveals information that should be highlighted: the number of head injuries represents the second most prevalent location together with the upper limbs.

Injuries in the head (especially bruising) and face should be treated with extreme caution, since they cause important loss in mental functions and memory.<sup>3</sup> The etiology of this type of injury has been attributed to contact mechanisms of head to head, head to upper limb (most often elbow), head to ball and head to goalpost.<sup>20</sup>

Dvorak and Junge<sup>21</sup> still believe that the number of head injuries in soccer players is underestimated due to athletes' fear that reporting the presence of head injury and symptoms associated with this condition are restrictive to their return to sports practice. A study of athletes participating in America's Cup 2015 placed the number of head injuries only behind the lower limbs (7 vs. 31),<sup>2</sup> justifying the recent interest in the investigation of this theme.

Regarding the upper limbs, the causes of injuries in this segment have also been attributed to specific overload in this segment in response to specific demands. Therefore, it is reasonable that they mainly occur in goalkeepers.

The last analyzed segment, the trunk was also one that had a lower prevalence of injuries and for which there is a greater scarcity of studies, making it difficult to make comparisons with the records of our study. The few studies found, include in this segment the injuries occurred in ribs, sternum and spine.<sup>7</sup> In the study of Bianco et al<sup>4</sup> the low back pain was the most reported condition, representing 15.9% of the total of injuries in this region (17 of 107).

In this context, the expressive limitation caused by injuries and symptoms located in the spine is important and requires attention from trainers and health professionals. Such conditions are often presented as either chronic or recurrent, and associated with degenerated vertebral discs and joints, fractures and spondylosis.<sup>22</sup>

Another epidemiological characteristic investigated in this research was the types of injuries for each location, which refer to the injured structures. In our survey, although those structures were exactly recorded, it was decided to group them as it has been previously done.<sup>1</sup>

There is consensus among researchers as to the location and type of the most frequent injury, a fact that also occurred in our study. As for the location, the values were even very close to those found by authors who investigated different athletes' profiles (amateur, professional or elite), of different ages and geographic regions. This makes us believe that for this injury characteristic, there is no relation to the geographic region where soccer is played, but yet to the anatomical location in which the physical demands for this sport are higher.

On the other hand, the numbers found in our study are higher than those of other studies on the type of injury. Although the muscle-tendon unit has been the most affected structure, as it was in similar studies, in our study this type of injury accounted for 40.2% of the total when considering all locations, or 43.5% of the total considering only injuries occurred in the lower limbs. Shalaj et al<sup>17</sup> in athletes who are also professionals, found for that type 28.7% in all locations, although having registered muscle injuries (23.9%) and tendon (4.8%) separately.

In amateur athletes, Herrero et al<sup>1</sup> initially recorded lesions in the muscle and tendon together, as defined by them, as a major grouping. In a second moment, the authors divided injuries into categories. In all cases the numbers found for these authors were different from those found in our study, with lower values, 17.4% (all types of muscle injuries) and 8.1, 3.7 and 5.6% for muscle strain, muscle cramp and tendon injury, respectively. Both studies were conducted in European countries and, as well as in our study, a period of two seasons was considered.

This pattern of incidence was also found in a study conducted in a different country,<sup>4</sup> but in the same continent. This reinforces the hypothesis already mentioned that differences in injury records from European athletes and South American athletes could be explained by soccer practice characteristics on different continents. These characteristics involve more intense mechanisms of injury, as it was evidenced in the greater number and intensity of contacts among players in South America.

Analyzing this aspect (mechanism of injury), in the present study the body contact accounted for 57.9% of the different types of injuries, including muscle-tendon unit, against 25.4 and 25.5% (athletes aged <30 vs. ≥30 years).<sup>1</sup>

Likewise, our values were higher than in other studies<sup>1,17</sup> also for joint injuries (45.8 vs. 35.4 and 39.9%) and bone injuries (6.5 vs. 2.6 and 6.4%), supporting the theory that physical force employed in sport is greater when practiced on the continent of this research.

This is clear when observing the studies of that region. For example, recently, in a study that followed the most important tournament among teams from different countries of South America, America's Cup 2015, it was revealed that more than half of the injuries occurred by contact mechanism.<sup>2</sup>

Specifically in Brazil, despite the lack of epidemiological studies, among those found and that evaluated athletes of different categories, levels and regions of the country, the results were predominantly close to ours.

Ribeiro et al<sup>10</sup> found a prevalence rate of 41% for muscle-tendon injuries and 25.8% for joint injuries in young athletes, while Vasconcelos Junior and Assis<sup>8</sup> found 40.0 and 35.0% in professional athletes for the same injuries, respectively. Palace et al<sup>9</sup> in a historical cohort study, followed players of a professional soccer team during the period of three years (2003–2005), when this team participated in the second division of the Brazilian Championship. The most common types of injuries found occurred in muscle (46.8%), ligamentous (26.6%) and bone (16.6%).

The third analysis of this research involved the severity of injuries. Considering both the different types together and those with higher prevalence (muscle-tendon and joint), the most severe degrees were those with higher numbers. These results differ from those found in previous studies in which less severe injuries or those of medium severity were prevalent.

Le Gall et al<sup>6</sup> in a cohort study that documented the injuries in young elite French athletes during 10 seasons, found that most injuries (60.2%) lasted less than a week. Similarly, Bianco et al<sup>4</sup> when evaluating professional athletes, but who practice on artificial grass, found higher prevalence of mild and moderate injuries, both in younger athletes (13–16 years) and older athletes (17–19 years). On the other hand, in natural grass, Bianco et al<sup>6</sup> evaluated professional athletes from 12 participating teams in a championship of the major Kosovo division. They recorded injuries occurred in a period of 2 seasons. The mild and moderate injuries were also considered the most prevalent.<sup>17</sup>

This predominance of injuries with lower severity compared to those shown in our results could be related to the intensity of matches and physical contact when soccer is practiced in our continent, especially in Brazil, the research site.

Regarding the number of occurrences of the same injury, the highlight of this study were the joint injuries, although not being the most prevalent, they were the most frequent ones.

In amateur athletes from Spain,<sup>1</sup> recurrent injuries accounted for 2.5% of the total, considering those that occurred in the head and neck, upper limbs, trunk and lower limbs together, these numbers are lower than those found in this study. In these same locations, but in professional athletes from the Australian Soccer League, Orchard e Seward<sup>23</sup> found recurrence rates of 17% by adding injuries of all locations along 4 seasons that, although being considered low, this percentage represents a number close to that found in the present study (18.7%).

As seen before, in addition to possible association with athletes' level (amateur or professional), other studies have shown an association of these lesions with additional factors, for example, reduced resting periods<sup>25</sup> and the quality of athletes' support, in terms of physical structure of clubs, available material and human resources.

In our research, the last aspect investigated by us can also explain the recurrent injuries, but in comparison with other studies, it was not possible because of the lack of studies investigating this same aspect. It concerns the athletes' symptomatic return to sports practice, which in our case occurred both among athletes who received, and among those who did not receive any treatment.

Previous injuries represent a powerful and well-documented risk factor for injuries in soccer, and when the symptoms are still

present, they can represent a factor that further increases the risk for recurrent lesions. Hägglund et al.<sup>24</sup> reported that the persistence of these risk factors after returning to sport can be a key factor.

However, that way, the investigated population although composed of professional athletes, also included teams whose financial difficulties and limitations of physical infrastructure and human resources are admittedly a reality in regions that are far from the major cities of the country, where soccer is practiced. Our hypothesis is that this may have largely contributed to these numbers of injury recurrence.

Unfortunately, however, there is a lack of studies that include such analysis in Brazil, with detailed surveys of these conditions and the identification of possible association with soccer injuries in the country. This is an important limitation found, which makes it difficult for our hypothesis to be confirmed or refuted and, at the same time, reinforces the need for research in this context.

In conclusion, joint injuries in the lower limbs derived from contact demands were the main sports injuries in Brazilian soccer players. Important proportions of those cases have been associated with morbidity higher than eight days, which is directly qualified as mild to severe injuries. Probably, lack of treatment and high number of recurrent injuries even for those who have received some type of treatment have sustained these findings. Also, results allowed the identification of similarities in relation to other studies that also investigated the epidemiological characteristics of soccer injuries.

Classically, the soccer practice is marked by physical contact and performance of specific sports actions such as running, jumping, landings, acceleration, slowdown, abrupt changes of direction, kicks and tramping<sup>26</sup>. Features such as resistance, velocity, agility, flexibility and strength are essential requirements to the full exercise of soccer. These physical demands, specific to soccer, are consensus in the literature<sup>26–28</sup> and, whether associated or not, may represent extrinsic causative factors related to the occurrence of sports injuries.

Therefore, a multifactorial approach should be used to integrate the main factors involved—that is, the internal and external risk factors as well as the inciting event (the injury mechanism).

Intrinsic characteristics, as disturbed posture and chronic joint instability, as well as extrinsic factors, including types of surface, and the lack of anatomical skills for joint protection<sup>26</sup> could be appointed as potential etiological agents of joint injuries in the lower limbs.

Therefore, further studies need to be conducted to confirm whether findings of this study are also observed in longitudinal analyses, and among athletes from other places and training centers. Also, it is important to investigate the potential of preventive interventions, such as segmental proprioceptive training, with the aim of applying preventive measures for treatment and preservation of soccer players.

Finally, as for the results considered different from those found in literature as well as the results considered unique, they allowed to establish the hypothesis that these injuries are related to soccer practice characteristics, and its organizational structure in the region where the research was conducted.

#### Authors' contribution

JJGJ is an undergraduate student (scientific initiation) who made the data record, tabulation and analysis staffs.

GMO took part in the production of the research Project, data record and posterior tabulation and analysis. He was also responsible for the contact with three of the teams participating in the research to obtain informed consent from athletes and team president.

FSSB was responsible for coordinating the statistical analysis and discussion of the results. PFM was responsible for the design and production of the research project from which this article was made, coordinating the work of data record staff and data analysis staff.

SAOJ was the general coordinator of the research, participating in all stages, guiding and coordinating the activities of all participants. He was the one responsible for the project in postgraduate and research sector of the university and in Ethical Committee.

#### Conflicts of interest

The authors have nothing to declare.

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