



UEFA
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FRANCE



Injury Study Report
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On behalf of the UEFA Medical Committee

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Summary of findings

The UEFA EURO 2016 injury study found that:

- ✧ Overall, injury problems were substantially lower during EURO 2016 compared with the EUROs in 2012, 2008 and 2004.
- ✧ Injury burden (the number of days of absence for every 1,000 hours of exposure) is a better way to describe the consequences of injuries since, unlike injury incidence, which describes the number of injuries for every 1,000 hours of exposure, injury burden also considers the severity of the injury.
- ✧ During the preparation phase (1 to 9 June) only slight injuries occurred.
- ✧ During the tournament itself, 46 players suffered 49 injuries and 80% of injuries occurred at matches.
- ✧ The injury burden for match play injuries was 16 times higher than for training session injuries.
- ✧ The number of injuries differed between different stages of the tournament: it was low in the preparation phase (and the injuries were only slight), it increased during the group stage and was highest in the knockout stage (including many severe injuries with long absences).
- ✧ The injury burden in EUROs has decreased and is now lower than in elite club football.
- ✧ 55% of all injuries recorded at the tournament were muscle injuries, and the percentage of muscle injuries has increased at every EURO since 2004. At present, muscle injury is clearly the major injury problem in elite level football.
- ✧ The percentage of non-contact match injuries is increasing compared with previous EUROs. This could be because contact injuries have diminished due to the fair play of players and high-quality refereeing. It indicates that non-contact injuries (mostly overuse injuries such as muscle injuries) have increased overall and that could be a sign of fatigue.
- ✧ There were fewer head and knee injuries at EURO 2016 and EURO 2012 than at EURO 2008.
- ✧ There were few re-injuries occurring at the tournament, suggesting that the quality of medical teams and their recommendations was high.



- ✂ There were few foul play injuries recorded EURO 2016, which could suggest changes in the nature of competition, or perhaps other factors, such as stronger control by referees.



Why was the study conducted?

Although the positive health effects of physical activity are well documented, participation in sport is associated with a certain injury risk, and in professional football the risk is substantial. It has been estimated that the overall risk of injury is about 1,000 times higher than in industrial occupations generally regarded as high risk (Drawer and Fuller, 2002). Injuries also have a negative impact on performance, and teams that can avoid injuries have greater success (Árnason et al., 2004; Bengtsson et al., 2013; Ekstrand et al., 1983; Hägglund et al., 2013). Hence, the prevention of injuries is of the utmost importance in football, and conducting an injury surveillance study is a fundamental first step in that prevention process (van Mechelen et al., 1992).

FIFA, UEFA and national football organisations are all concerned about the safety of players. In 2001 UEFA initiated a research programme with the aim of increasing the safety of players in its competitions and contributing to the wider understanding of injury in sport. This project, the UEFA Elite Club Injury Study, has now been conducted in the UEFA Champions League for 15 years, with the results regularly published on <http://www.uefa.org/protecting-the-game/medical/index.html> and in international peer-reviewed sports medicine journals, such as the British Journal of Sports Medicine.

Starting with EURO 2004 in Portugal, injury studies have also been carried out during European Championship final tournaments, and have been implemented as a matter of routine since then.

Study aims

The aims of the EURO 2016 injury study were as follows:

- ✧ To evaluate the injury risk and circumstances of injury during EURO 2016, taking into account exposure during training sessions and matches.
- ✧ To analyse injury patterns and injury severity.
- ✧ To compare injury risk and injury patterns with previous tournaments and with the UEFA Elite Club Injury Study.
- ✧ To compare differences in injury risk between the preparation phase, the group stage and the knockout stage.
- ✧ To contribute to the existing UEFA injury study database, and to monitor trends in injury risk and injury patterns over time.



How was the study conducted?

Teams and players

All 24 teams who qualified for EURO 2016 agreed to participate in the study. Each squad comprised 23 players. All teams but one sent us complete data. We followed the 529 players from the 23 teams that provided complete data from 1 June to 10 July.

The study period was divided as follows:

- preparation phase (1 to 9 June)
- group stage (10 to 22 June)
- knockout stage (25 June to 10 July)

Each team played three matches during the group stage from 10 to 22 June, with the knockout stage (round of 16 to final) from 25 June to 10 July. The matches were played at ten different venues, all with natural grass pitches.

Data collection

Data collection followed the methodology previously validated and implemented via the UEFA Elite Club Injury Study and during previous European Final Championships. This enables continuous monitoring and comparison of injury risks and trends over time. Data collection was performed using standardised forms.

Each team doctor was responsible for data collection. Each doctor was provided with a study manual and data collection forms before the tournament and was briefed about the study procedure in a meeting with the head of the Injury Study Group and UEFA representatives on 3 March 2016. The manual contained information about the study's purpose, its design and relevant definitions, as well as examples of how to fill in the data collection forms.

Each team doctor was also provided with attendance record forms and was responsible for completing them with data about the players' attendance at training sessions and matches. Exposure times were registered in minutes for each individual player in order to base the incidence of injury on real exposure time. The attendance records included all matches and coach-directed sessions that included physical activity.

All injuries that occurred during the tournament were reported by the relevant team doctor. Basic information was recorded, such as the activity when the injury occurred (training or match), the minute of the match, the type, location and diagnosis of the injury, whether it was a re-injury, the



circumstances (contact or non-contact) and the mechanism of injury (overuse or trauma). For match injuries, the referee's sanction was also recorded.

Injury severity was evaluated based on the number of days' absence from training and match play (slight: 0 days, minimal: 1–3 days, mild: 4–7 days, moderate: 8–28 days and severe: >28 days). All injuries were followed until the final rehabilitation date (Figure 1).



Figure 1. Injury severity based on numbers of days' absence

In order to evaluate the correlation between the internal load on players and injuries versus performance, the teams were also asked to provide data on the rate of perceived exertion (RPE) after each training session and match. A total of 17 teams agreed to participate in measuring RPE. The results of this sub-study will be sent separately to the teams who provided RPE data by the end of this year.

Definitions

- **Injury** was defined as any physical damage that occurred during football activities (scheduled matches or training sessions) which resulted in the player being unable to participate fully in training sessions or matches. A player was considered injured until the team doctor allowed full participation in team training and match play.
- **Re-injury** was defined as an injury in the same body location and of the same type as an injury that the player had suffered within the previous two months.
- **Injury rate** was expressed as the number of injuries for every 1,000 hours of exposure.
- **Days' absence** was defined as the total number of days lost because of specific injuries.
- **Injury burden** is a combined measure of the frequency (injury rate) and severity (days' absence) of injuries, giving the burden of injury for the player and the consequences for the team. Injury burden is expressed as the number of days' absence for every 1,000 hours of exposure. Example: Team A, with 10 injuries in 5,000 hours, each resulting in an absence of 10 days on average, has an injury burden of 20 days for every 1,000 hours. Team B, with 20 injuries in 5,000 hours, each resulting in an absence of 5 days on average, also has an injury burden of 20 days for every 1,000 hours.



RESULTS

The preparation phase (1 to 9 June): only slight injuries

On average, teams reported seven training sessions during these nine days. There was a wide variation between the teams, ranging from four to eleven sessions. Most teams also played one friendly match during the period.

The mean total exposure for training sessions and matches during the period was 193 hours for each team, with variation between 110 and 333 hours. In total, 18 injuries occurred: 14 at matches and 4 at training sessions. The injury rate was very low at training sessions (1.0 for every 1,000 hours) but substantially higher at matches (30.2 for every 1,000 hours) (see Figure 2 and Table 1). No severe injuries were reported. The majority of injuries (14 out of 18, or 78%) were minimal, with absences of 1 to 3 days, and all players injured during the preparation phase were eligible for their team's first match in the tournament.

The injury burden was low for training injuries (3.5 days lost for every 1,000 training hours) but substantially higher for match injuries (66 days lost for every 1,000 hours of match play). Both the injury rate and the injury burden show that during the preparation phase the risk of injury is around 20 to 30 times higher during match play than during training sessions.

The tournament phase (10 June to 10 July): high risk during matches

Exposure

In total, 8,500 hours of exposure were recorded during the tournament itself, with approximately 6,800 training hours (80%) and 1,700 match hours, including extra time (20%). In total, the 23 teams delivering data played 99 matches.

General injury risk

A total of 46 players (9%) suffered 49 injuries during the tournament. Thirty-nine of the injuries occurred during matches (80%) and ten during training (20%).

Injury rate: the mean injury rate at training sessions was 1.6 injuries for every 1,000 training hours, with rates varying from 0 to 8.5. The mean injury rate at matches was 22.6 injuries for every 1,000 match hours, with rates varying between 0 and 61.1.

Injury burden: the mean injury burden from injuries at training sessions was 17 days for every 1,000 hours of training, while the mean injury burden from injuries during matches was 271 days for every 1,000 hours of match play.



Comparing injury in the preparation phase, group stage and knockout stage

The exposure, injury numbers and incidence data for the three phases of EURO 2016 are shown in Table 1.

Table 1. Exposure, injury and incidence for the three phases

	Preparation phase (PP)	Group stage	Knockout stage	Tournament excluding PP	Tournament including PP
Exposure data					
Training sessions (n)	157	201	104	305	462
Matches (n)	28	69	30	99	127
Total activities (n)	185	270	134	404	589
Training exposure (h)	3,981	4,491	2,281	6,772	10,754
Match play exposure (h)	464	1,164	563	1,727	2,190
Total exposure (h)	4,445	5,655	2,844	8,499	12,944
Injury data					
Training injuries (n)	4	5	5	10	14
Match play injuries (n)	14	29	10	39	53
Total injuries (n)	18	34	15	49	67
Incidence data					
Training injury rate	1.0	1.3	2.2	1.6	1.4
Match play injury rate	30.2	24.1	19.5	22.6	24.2

n = number, h = hours

A finding this year and at previous EUROS has been that the injury rate is higher in the group stage than in the knockout stage. For this year's EURO, we also included the preparation phase in the survey. As seen in Figure 2, the injury rate at preparation phase was higher than in the tournament itself and, as at previous EUROS, the injury rate during matches was higher in the group stage than in the knockout stage. The trend for injuries during training was the opposite, but, overall, the risk for injuries at training sessions was low.

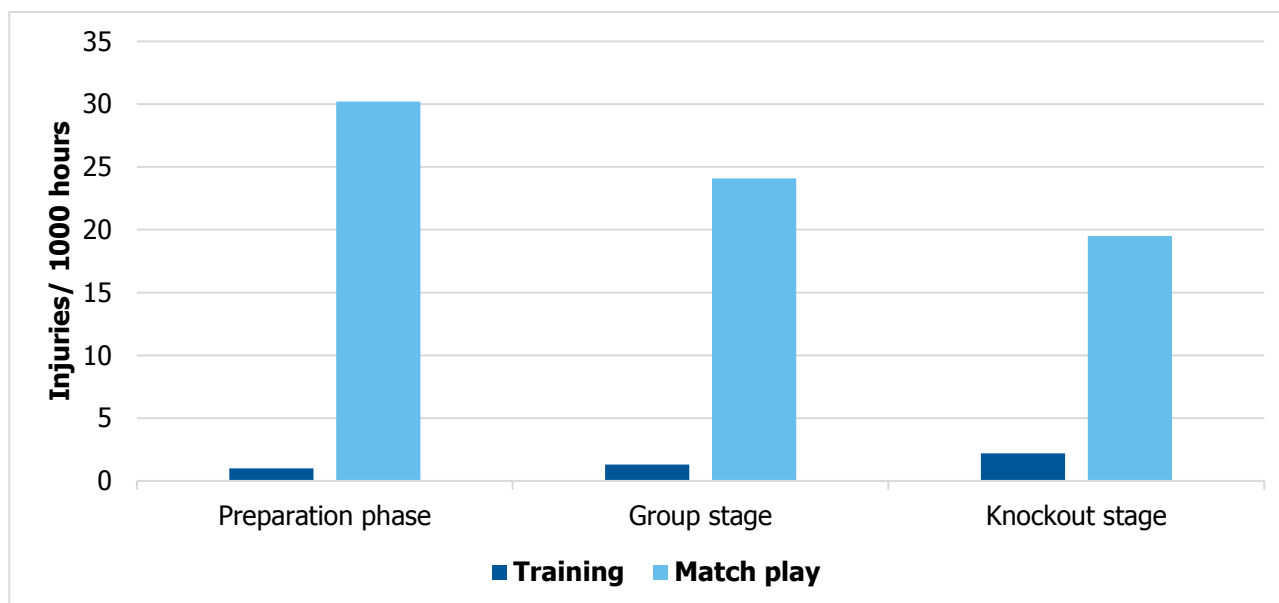


Figure 2. Injury rate in the different phases of EURO 2016

However, the incidence of injuries might not be the best way of showing the practical consequences of injury. The injury rate only reflects the number of injuries during a certain exposure time (usually 1,000 hours). The severity of the injury is not considered, so, for example, a contusion injury of the thigh with one day's absence is considered equal to an anterior cruciate ligament (ACL) injury with seven months of absence.

In Figure 2, the number of injuries at matches is highest during the preparation phase and lowest in the knockout stage. However, this does not reflect the danger in each phase – it merely reflects a difference in philosophy. During the preparation phase, the teams want to prepare the players for the tournament in the best way possible. The teams therefore allow players with minor complaints to rest for one or two training sessions in order to have the players fresh at the start of the tournament.

Injury burden is a much better way of expressing the consequences of an injury. As seen in Figure 3, the injury burden is low during the preparation phase, increases substantially during the group stage and increases even more during the knockout stage.

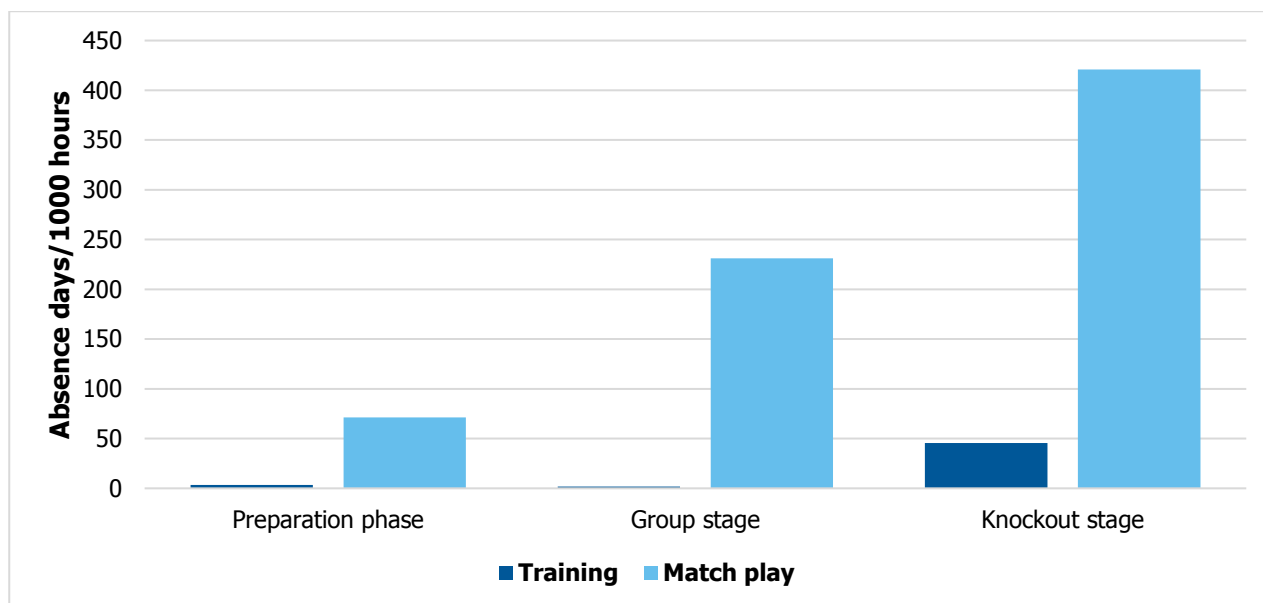


Figure 3. Injury burden in the different phases of EURO 2016

The injury burden at EUROS has diminished and is now lower than in elite club football

As seen in Figure 4, match play injuries have a higher burden and more severe consequences than training injuries. It is also clear that the match play injury burden is lower than that recorded in the UEFA Elite Club Injury Study. Further, the overall injury burden at EURO 2016 was clearly lower than the injury burden for elite club football during the 2015/16 season.

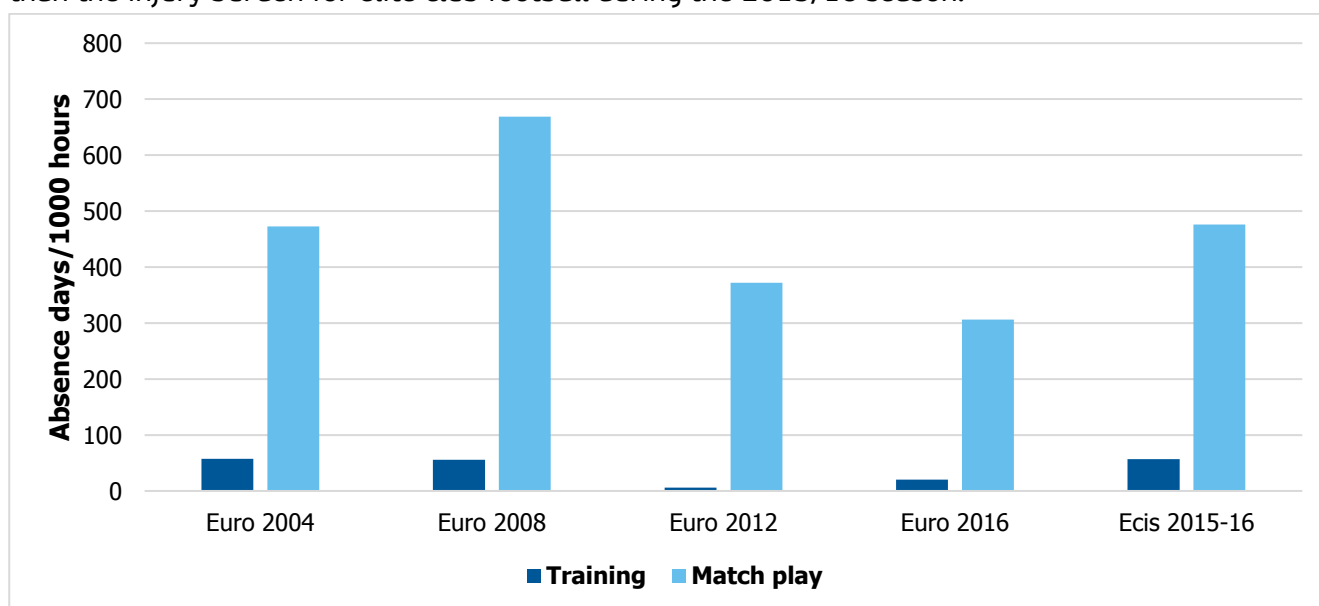


Figure 4. Injury burden at the last four EUROS and during the 2015/16 UEFA Elite Club Injury Study



Severity of injuries compared with previous EUROS

For the majority of injuries (n=31, 63%) the injured player returned to full training and match play within one week. However, nine injuries (18%) were moderate, with absences of 8 to 28 days, and another nine injuries (18%) were severe, causing absences of more than 28 days.

Injury patterns

The majority of injuries (87%) were to the lower extremities, the most frequent locations being the thigh (n=16, 33%), hip/groin (n=12, 25%), knee (n=6, 12%) and ankle (n=6, 12%). The other nine injuries were to the lower back (n=3), head/face (n=2), lower leg/Achilles tendon (n=2), foot/toe (n=1), and hand (n=1). Compared with EURO 2012, the percentage of hip/groin injuries increased from 11% to 25% and the percentage of thigh injuries decreased from 43% to 33%.

As seen in Figure 5, the injury pattern at EURO 2016 is very similar to the injury pattern at elite club level during the 2015/16 season.

Muscle injuries were the most dominant injury type at EURO 2016 (n=27, 55%). As seen in Figure 5, the percentage of muscle injuries has increased at every EURO and in UEFA Elite Club Injury Study. Muscle injury is clearly the major injury problem for players at elite level.

One-fifth of all injuries at the tournament were hamstring muscle injuries, and since this so-called 'sprinter's injury' mainly occurs when players are running at high speed and with quick changes of direction, these injuries could reflect the high intensity of the match play at EURO 2016.

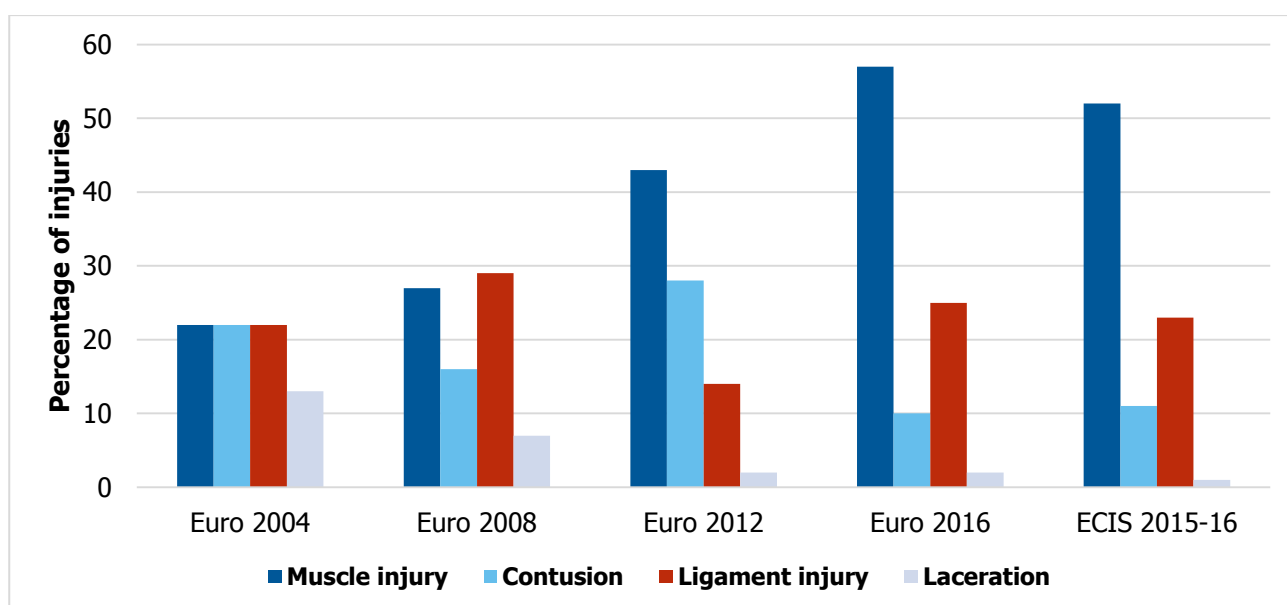




Figure 5. Percentage of injury types at the last four EUROS and during the 2015/16 Champions League

Fewer head and knee injuries compared with UEFA EURO 2008

During EURO 2008, as many as five head injuries were recorded, including fractures, concussions and wounds. However, during EURO 2012 only one head injury was reported and during EURO 2016 only two. One of the head injuries during EURO 2016 was a laceration caused by the elbow of an opponent who was tackling the injured player, which caused concussion. The referee's sanction was a yellow card. The other concussion was caused when the player was hit by the ball. In accordance with the new recommendations from UEFA concerning head injuries, the team doctors were given the opportunity to carry out a proper assessment of the injured player in order to determine whether he was fit to continue the match or not.

During EURO 2008 six severe knee injuries occurred, three of which needed surgery. During EURO 2012, only one severe knee injury was reported, which was an ACL injury. During EURO 2016 no ACL injuries occurred but two medial collateral ligament injuries caused long absences.

Players leaving the tournament due to injury

Contact was continued with the team doctors after the tournament in order to evaluate the total absence from injury and other consequences for the players.

Fifteen players were still injured when their team exited the tournament. Nine players left the tournament with severe injuries causing absences of more than 28 days (see Table 2). The majority of players who left the tournament still injured (7 out of 9, 78%) had suffered injuries in non-contact situations.

Table 2. Players who left UEFA EURO 2016 with injuries.

Severe = an injury causing an absence of 28 days +, moderate = an injury causing an absence of 8–28 days.

Number	Diagnosis	Contact	Foul	Severity
3	Hamstring muscle injury	No	No	Severe
2	Rupture of the medial collateral ligament	Yes	No	Severe
2	Ankle ligament injury	No	No	Severe
2	Adductor muscle injury	No	No	Severe
3	Adductor muscle injury	No	No	Moderate
1	Quadriceps muscle injury	Yes	Yes	Moderate
1	Quadriceps muscle injury	No	No	Moderate
1	Hamstring muscle injury	No	No	Moderate



Re-injuries

As at previous EUROS, there were few recurrent injuries. Recurrence rates of 13% were documented in the UEFA Elite Club Injury Study, while only two re-injuries (4%) were observed at EURO 2016. This suggests that a high standard of medical support was provided for teams during the tournament and also that return-to-play decisions made by team medical staff were successful.

Match injuries

A total of 13 of the 39 match injuries (33%) were due to player-to-player contact and 5 of these (38%) were due to foul play (according to the referee) (see Figure 6). Out of the eight contact injuries that were not considered foul play by the referees, five were caused by tackling, two by kicks from opponents and one by a collision. Three of the injuries considered non-foul injuries were knee ligament injuries, and two of these were severe, with long absences.

Non-contact match injuries are increasing

The rates of match injuries occurring through player-to-player contact have shown a downward trend during the latest three EUROS, while an upward trend has been seen for non-contact match injuries (Figure 6). Further, during EURO 2016, the average absence for non-contact injuries was twice as long as for contact injuries (12 days versus 6 days).

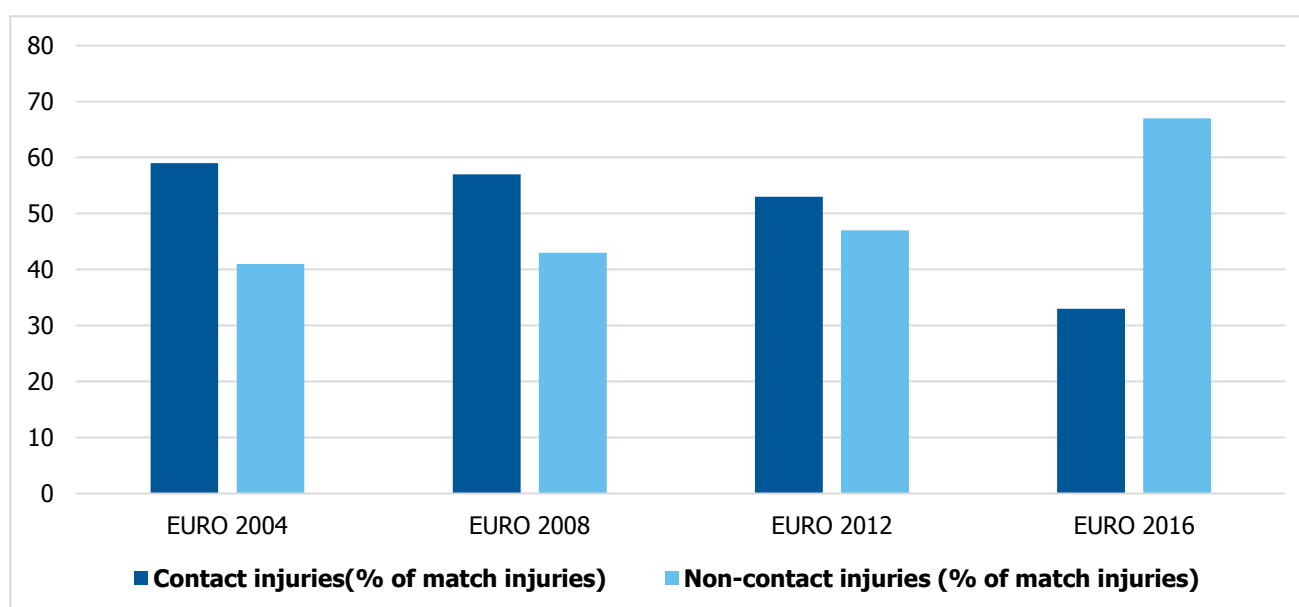


Figure 6. Mechanisms of match injuries during the last four EUROS



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