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VBG Expertise

Including the key issue of workload management

VBG Sports Report 2019

Analysis of accidents in the top two men's leagues in basketball, hockey, soccer, and handball

A longitudinal study of three consecutive seasons


HARTING
AOK
SHAMIR
55

1 Foreword

Dear Readers,

Around 22,300 injuries in three seasons clearly show that sports injuries are not a matter of fate.

In this fourth edition of the VBG Sports Report, we are entering uncharted waters for you: For the first time, we are not examining the past season for the four leading team sports—basketball, hockey, soccer, and handball—but analyzing three consecutive seasons. This separate analysis enables us to present trends and developments that remain hidden in the cross-sectional examination of a single season. The overall examination of the 2014/15, 2015/16, and 2016/17 seasons also results in a database with a total of nearly 22,300 acute injuries in the top two men's leagues for the four sports mentioned above. There are only a few epidemiological studies in professional sports worldwide that are based on a larger number of cases.

Accordingly, the evaluations presented on the following pages are highly informative regarding the occurrence of injuries, revealing clear spheres of activity for prevention in basketball, hockey, soccer, and handball. In particular, the comparison of individual teams within the same league exhibits striking differences across all sports. We believe this supports only one conclusion: A reduction in injury rates, days missed, and costs is possible, even under the strenuous conditions of professional sports. It seems that some teams are pursuing better concepts for maintaining their players' health than others.

In view of current international studies and our own evaluations, there is reason to suspect that individual workload management is a key influencing factor here. That is why we chose this as the key issue for the 2019 edition, which documents to what extent overloading and a lack of regeneration can constitute injury risk factors. In particular, however, we want to show you how the VBG assists sports teams by recording individual stress conditions and exploring workload management based on that.

With the VBG Sports Report 2019, we hope once again to provide you with helpful information on the distribution and origins of sports injuries as well as on the derivation of constructive preventive countermeasures. As a sports partner, the VBG will keep striving to help sports organizations maintain their athletes' health through innovative, practicable, resource-saving prevention and rehabilitation offers going forward.

You will find information, media, and additional helpful tools on the VBG Internet sports page under: www.vbg.de/sport.

With kind regards,

Angelika Hölscher Chairperson	Prof. Bernd Petri Member of Management	Dr. Andreas Weber Director of Prevention

VBG – Your statutory accident insurance provider

The VBG is a statutory accident insurance provider, insuring more than 1.2 million companies—from architectural offices to temporary employment agencies—in over 100 industries across Germany. Its mandate consists of two core tasks: The first is the prevention of occupational accidents, illnesses, and health hazards. The second is fast and competent action on claims to provide optimum support for the insured person's recovery. With nearly 480,000 reported accidents and occupational illnesses per year, the VBG supports insured persons with the goal of helping them return to work and life in the community. At eleven locations in Germany, 2,400 VBG employees look after the concerns of our customers. Seven VBG academies offer occupational health and safety seminars.

Further information: www.vbg.de

2 Methodology – approach, definitions, and concepts

Observed leagues and players

The analysis of accidents included all players in the respective top two men's leagues in

Basketball:
easyCredit Basketball Bundesliga[1]
(in the following: BB1)
ProA 2. Basketball Bundesliga (BB2)

Hockey:
Deutsche Eishockey Liga (EH1)
Deutsche Eishockey Liga 2 (EH2)

Soccer:
Bundesliga (FB1)
2. Bundesliga (FB2)

Handball:
DKB Handball-Bundesliga (HB1)[1]
2. Handball-Bundesliga (HB2)

who, in the 2014/15, 2015/16, and 2016/17 seasons during the period from July 1, 2014 to June 30, 2017, played in at least one official match in national or international competitions for their team.

total population

Recorded variables: including age, league, playing position

Promoter license/dual play right/ team change

Players who played in both the first and second leagues due to a promoter license, dual play right, or team change during the observation period are included in both league populations in the comparison of the leagues (for example, prevalences and incidences). Conversely, in the analysis of the sport as a whole, each player is statistically considered only one person.

1 Still under the name Beko Basketball Bundesliga in the 2014/15 season

2 Under the name LIQUI MOLY Handball-Bundesliga since the 2019/20 season

Injury analysis

Injuries in the 2014/15, 2015/16, and 2016/17 seasons (period: July 1, 2014 to June 30, 2017) were examined for the general injury analysis.

All insured events that led to financial benefits (treatment and compensation for lost remuneration) paid by the VBG and/or due to a player's incapacity for work were included.

We counted the number of injuries in our analysis. Some accidents also caused two or more injuries.

Injury population

(Data respectively as of September after the end of a season). Recorded variables include the injured body region, type of injury, treatment costs, and incapacity for work.

The data were taken from the VBG data warehouse approximately three to four months after the end of the season, as of September 15 of the respective year. Thus, the benefits reported for treatments and compensation for lost remuneration only include benefits paid by the VBG up to September 15.

The duration or expected duration of the incapacity for work was also examined as of the data retrieval date of September 15.

Benefits and the incapacity for work were used as indicators for the injury severity under consideration of the aforementioned restrictions.

During the preparation of the first VBG Sports Report 2016, the number of players included in the total population for the sport of soccer was erroneously too high. This has been corrected in the retrospective examination of the 2014/15 season in this edition of the VBG Sports Report. Some results therefore deviate from the VBG Sports Report 2016.

Analysis of the causes of injury

Moderate and severe competitive injuries resulting in an incapacity for work of seven days or more and/or benefits of EUR 1,000 or more paid by the VBG were taken into account for the systematic video analysis of the causes of injury, insofar as they could be identified in the video material.

Video population

(Data as of 08/2018) Recorded variables: including place and time of the injury, match situation, movement patterns, match action, injury mechanism, cause of injury

The limits of seven days (primary) and EUR 1,000 (secondary) were chosen since current studies in the field of sports accident research show that the identification rate of less serious injuries in sports video material drops considerably. Moderate and severe injuries also have a higher relevance for prevention due to their severity of damage and the associated more serious personal, sports-related, and economic consequences.

Since insured events from the beginning of the season are further back in time upon data retrieval, so that they are more likely to exceed the EUR 1,000 limit where applicable, one can assume that the video population tends to underrepresent the insured events from the end of the season. The data analysis, however, showed that this effect can be disregarded since the proportion of the cases selected from the injury population in reference to the time in the season was statistically insignificant.

Definitions and concepts

Injury

An injury is defined as any event in training or competition that either leads to treatment costs or to a player's incapacity for work in future training and/or match sessions. Pain or chronic damage that is not of a posttraumatic nature as well as illnesses or mental impairments are excluded in this context.

Benefits

Benefits are defined as all payments by the VBG for treatment costs and compensation for lost remuneration up to September 15 of the respective year for injuries sustained in the observation period (July 1, 2014 to June 30, 2017). VBG benefits that go beyond this date are disregarded for the purpose of standardization and year-on-year comparability.

Prevalence

Prevalence refers to the proportion of the observed players (total population) who suffered at least one injury in the observation period.

Incidence

Incidence indicates the number of injuries sustained in relation to the observed players' exposure time. The following incidence types are used:

- Season incidence: Number of injuries per player and season
- Competition incidence: Number of competitive injuries per 1,000 hours of competition
- League incidence: Number of injuries per 1,000 league match hours

Relative injury burden

The injury burden describes the burden resulting from injuries. In this VBG Sports Report, it is expressed in the form of days missed and/or benefits.
To permit the comparative examination of these resulting burdens within the analyzed leagues in terms of a benchmark, we decided to calculate the relative injury burden. For this purpose, the total number of days missed for each team is divided by the number of official matches for the respective team. To minimize the risk of bias due to different reporting behavior in this calculation, only injuries subject to mandatory reporting (≥ 4 days missed) were included in calculating the injury burden.

Contact injury

A contact injury is any injury caused by a direct external application of force by another person (such as a fellow player, opposing player, or referee) or an object (such as a ball, puck, stick, goal, boards, or basket) to the injured and/or adjacent body regions.

⇢ Example: Ankle injuries after an opposing player kicks the ankle or lower leg

Indirect contact injury

An indirect contact injury is any injury involving the external application of force by another person or an object directly before or during the injury. This does not directly cause the injury but influences the player's natural motion sequence and, therefore, indirectly leads to the situation that causes an injury.

⇢ Example: Ankle injuries after twisting the ankle upon landing after an impact to the upper body in the airborne phase

Noncontact injury

A noncontact injury is any injury that is caused without the application of force by another player, play equipment, or playing field equipment.

⇢ Example: Ankle injuries after twisting the ankle during a quick direction change

3 Fact check – brief overview of the 2014/15, 2015/16, and 2016/17 seasons

	Basketball			Hockey		
	BB1	**BB2**	**total**	**EH1**	**EH2**	**total**
Number of injuries	1,964	1,083	3,047	2,945	2,696	5,641
Average cadre size (players)	16	15	15	27	28	28
Cumulative season incidences	2.30	1.55	1.92	2.58	2.28	2.43
Average downtime per injury (days)	14	18	15	21	25	23
Average costs per injury (EUR)	995	770	915	1,445	1,315	1,380
Average downtime per player and season (days)	17	14	16	20	24	22
League incidences (injury/1,000 league match hours)	104.52	84.32	95.45	130.41	113.26	121.74
Average number of injuries per team and season (spread)*	9 (3–35)	6 (0–17)	8 (0–35)	17 (12–26)	18 (3–41)	17 (3–41)
Average number of days missed per team and season (spread)*	260 (32–756)	195 (0–2,036)	229 (0–2,036)	519 (127–1,104)	653 (107–1,391)	586 (107–1,391)
Average number of days missed per official match (spread)*	6.5 (0.7–22.2)	5.9 (0.0–58.2)	6.2 (0.0–58.2)	8.6 (1.7–18.2)	10.8 (1.8–25.3)	9.7 (1.7–25.3)
Distribution of injuries – training : official match	56.9 : 43.1	58.3 : 41.7	57.4 : 42.6	28.1 : 71.9	31.8 : 68.2	29.8 : 70.2
Most frequently injured body region	Ankle	Ankle	Ankle	Head	Head	Head

* Only injuries subject to mandatory reporting (≥ 4 days missed) were considered.

The summary view of the three consecutive 2014/15, 2015/16, and 2016/17 seasons allows us to use a total of nearly 22,300 injuries from the top two men's leagues in basketball, hockey, soccer, and handball as the basis. In addition to the higher informative value due to the larger number of cases compared to the previous examinations of single seasons, this edition of the VBG Sports Report is also able to present longitudinal developments.

Regarding the cumulative season incidences, the finding of the VBG Sports Report editions from 2016 to 2018 that basketball has the lowest injury occurrence per player and season (1.92) is confirmed, while soccer, with an average of 2.66 injuries per player and season, shows the highest cumulative incidence rates across the entire observation period. However, the average downtime per injury at 11 days is lowest in soccer, less than half as long compared to the sports of hockey (23 days) and handball (27 days).

Soccer			Handball			
FB1	**FB2**	**total**	**HB1**	**HB2**	**total**	**total**
3,838	3,655	7,493	3,233	2,877	6,110	**22,291**
26	26	26	20	20	20	**22**
2.63	2.68	2.66	2.87	2.41	2.64	**2.41**
12	10	11	25	30	27	**19**
1,275	1,230	1,250	1,410	1,040	1,240	**1,200**
30	25	28	28	30	29	**23**
46.85	50.21	48.53	86.32	74.88	79.95	**86.42**
26 (6–61)	22 (3–46)	24 (3–61)	15 (1–46)	14 (1–44)	14 (1–46)	**16** **(0–61)**
742 (127–1,748)	649 (91–1,505)	696 (91–1,748)	553 (74–1,243)	569 (34–1,428)	561 (34–1,428)	**518** **(0–2,036)**
18.1 (3.5–44.6)	17.9 (2.6–40.7)	18.0 (2.6–44.6)	13.6 (2.1–33.6)	14.0 (0.9–35.7)	13.8 (0.9–35.7)	**11.9** **(0.0–58.2)**
55.3 : 44.7	57.9 : 42.1	56.7 : 43.3	56.9 : 43.1	55.4 : 44.6	56.1 : 43.9	**49.8 : 50.2**
Thigh	Thigh	Thigh	Knee	Ankle	Knee	**Thigh**

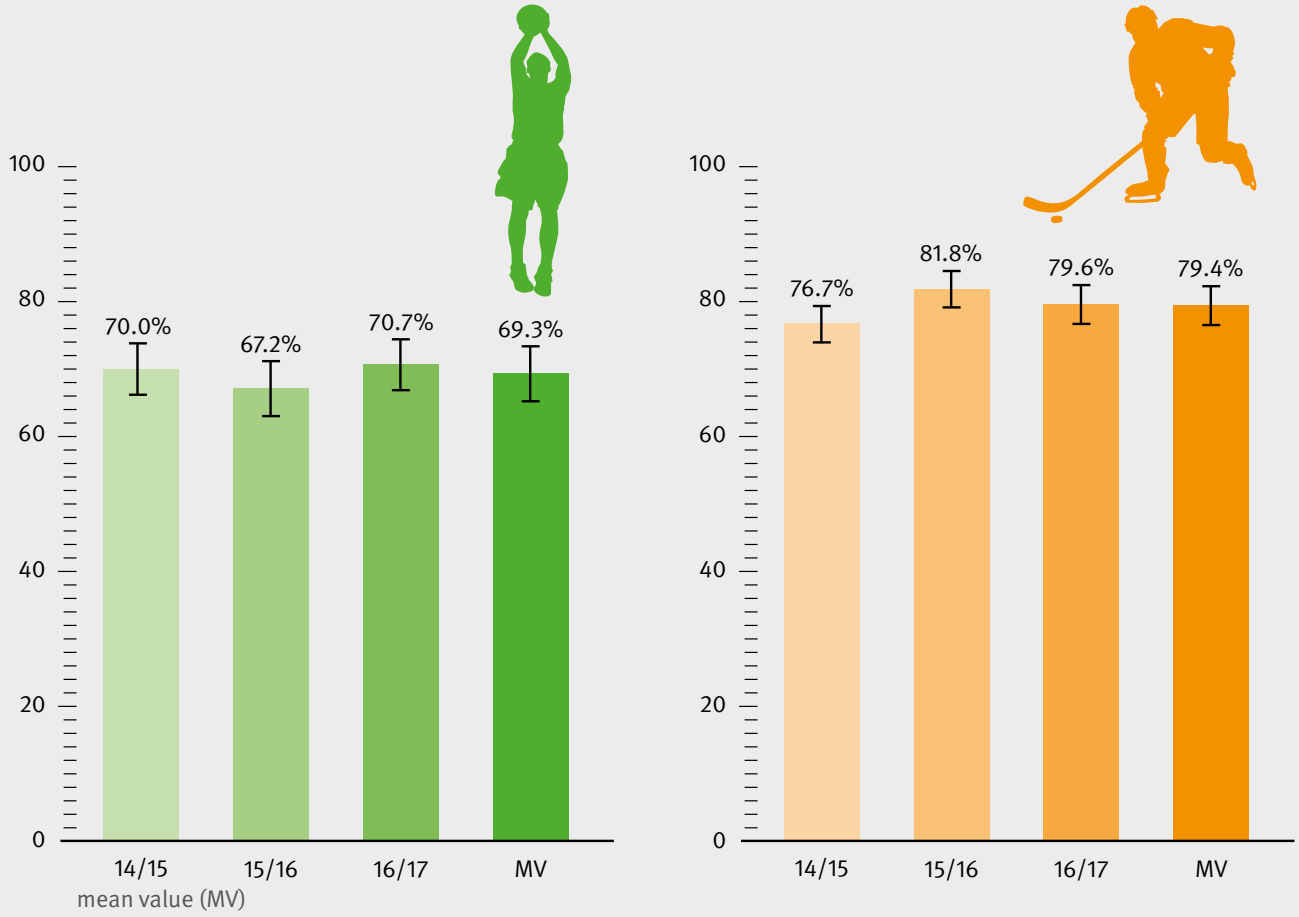
On average in the course a season, each player is unavailable to their team due to an injury for more than two weeks in basketball, around three weeks in hockey, and nearly a month in soccer and handball. However, it is striking to note that considerable differences are revealed in comparing the number of injuries and days missed among the individual teams within a league across all sports. Thus, the range for injuries subject to mandatory reporting, meaning injuries resulting in at least four days missed, is between 0 and 61 injuries per team and season in the examination across sports.

Regarding the resulting days missed, the range is 0 to 2,036 days per team and season. The enormous spread within the same leagues and, therefore, the comparable surrounding conditions reveal the tremendous potential for reducing sports injuries at the highest national performance level.

4 Injuries – comparison between the sports

Prevalence

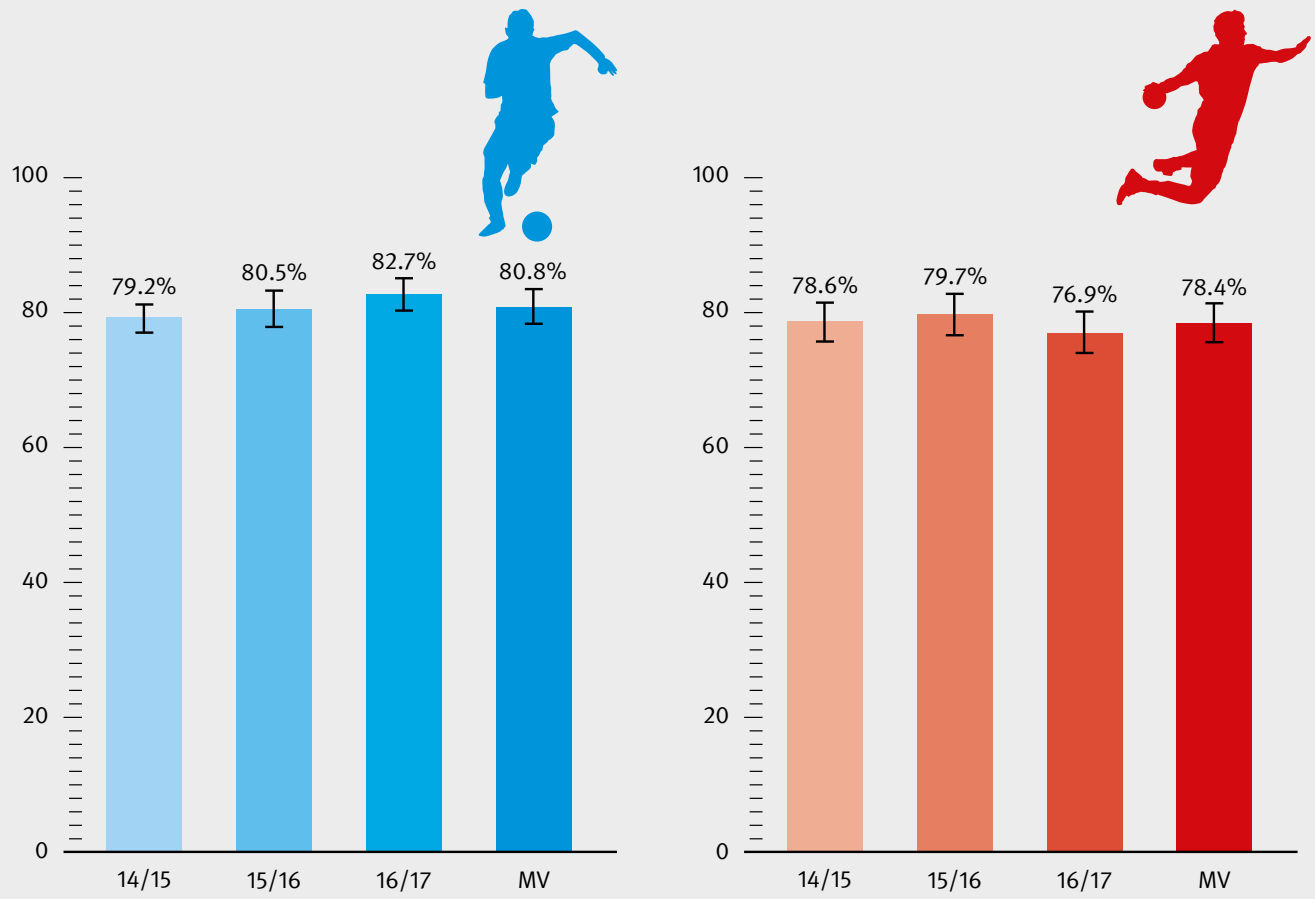
Proportion (%) of injured players, season comparison (± 95% confidence interval)



The prevalence of injury, meaning the proportion of players out of the total population who are injured at least once in the course of a season, is around 80% in the sports of hockey, soccer, and handball and around 70% in basketball.

Statistically relevant developments cannot be identified for the injury prevalence in any of the four sports in the longitudinal study of the three observed seasons. A different picture emerges for the incidences (see the following double-page spread): In view of the cumulative season incidences, the most recent hockey season in the observation period (2016/17) shows a statistically significant decrease compared to the previous season. Significantly fewer injuries per player were counted in the second of the three observed seasons for soccer compared to the other two seasons. Handball, conversely, showed a continuous increase in the cumulative season incidences across all three years, ultimately reaching statistical significance in a comparison of the third to the first observed season.

A comparable development is also seen in the examination of the league incidences (see the following double-page spread)—the number of injuries per 1,000 league match hours. Here, it becomes clear however that the incidence rates in soccer, with an average of 48.5 injuries per 1,000 hours of league play time, are considerably lower than in the other sports. The incidence rates in basketball are approximately double (95.5) and are higher by a factor of 2.5 in hockey (121.7) than the rate observed in soccer.



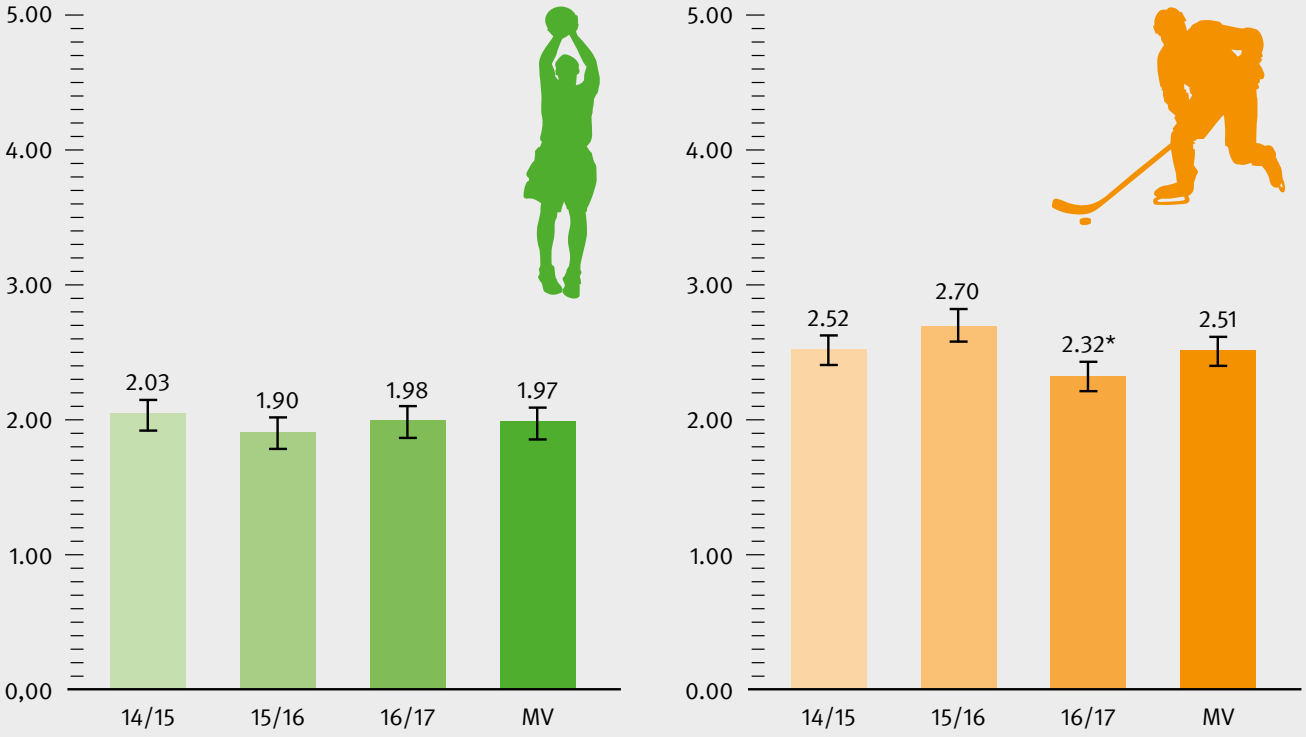
Examining the total days missed resulting from the injuries inverts the picture: The burden is lowest in basketball, with an average of 8,200 days per season. In hockey. the recorded downtime is twice as high, with about 16,900 days missed per season. The values are three times as high in handball (about 22,200 days missed) and soccer (about 25,900 days missed).

These comparisons illustrate that the parameters commonly used in epidemiology, examined on their own, only provide limited information about the occurrence of injuries. While prevalences and incidences do not allow any conclusions to be drawn about the injury severity, no exposure times are considered in examining the injury burden, which is expressed here as days missed.

In the interest of attaining the best possible comparison between individual teams within the same sport, we therefore decided to calculate the relative injury burden as an additional parameter in the following. This is the sum of all the days missed divided by the number of official matches. To minimize the risk of bias due to different reporting behavior in this calculation, only injuries subject to mandatory reporting (≥ 4 days missed) were included in calculating the injury burden.

Cumulative season incidence

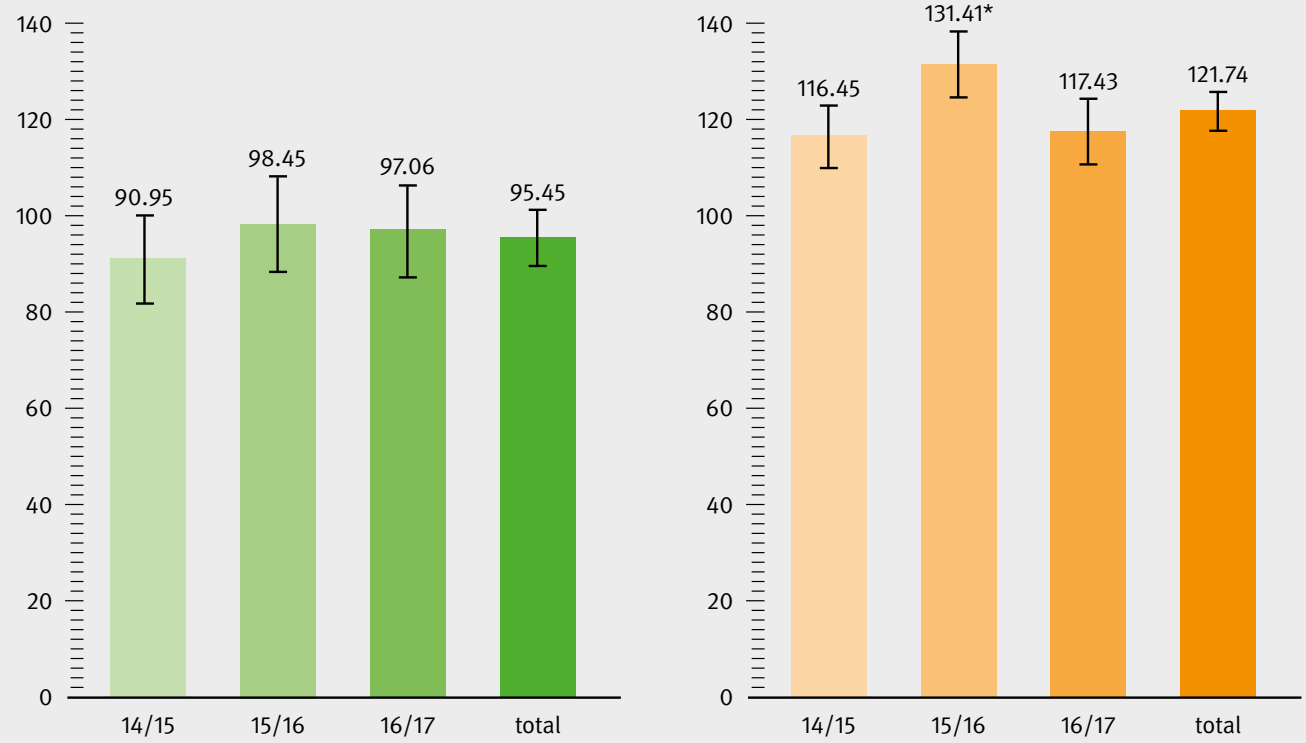
Number of injuries (n) per player, season comparison (±95% confidence interval)



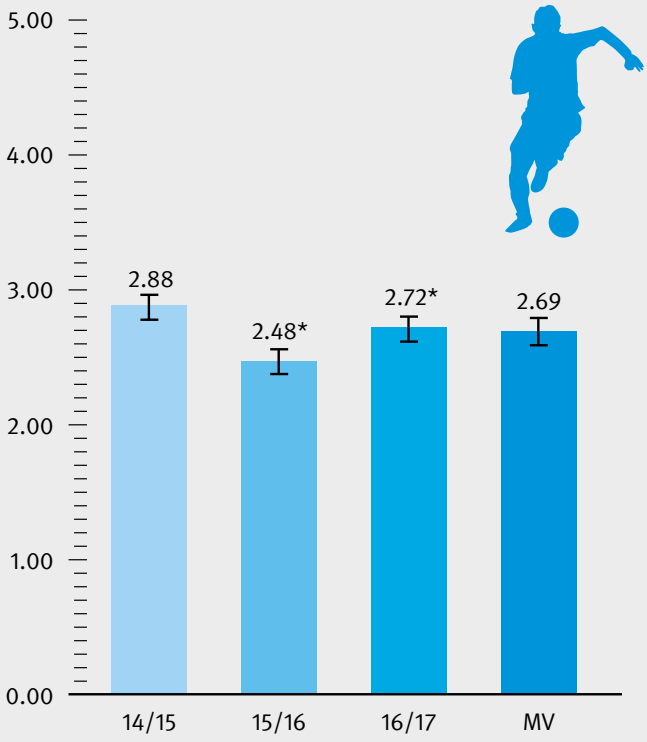
* Statistically significant difference compared to prior year | ** Statistically significant difference compared to 2014/15 mean value (MV)

League incidence

Number of injuries (n) per 1,000 league match hours, season comparison (±95% confidence interval)



* Statistically significant difference compared to prior year


5.00
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2.72*
2.69
14/15
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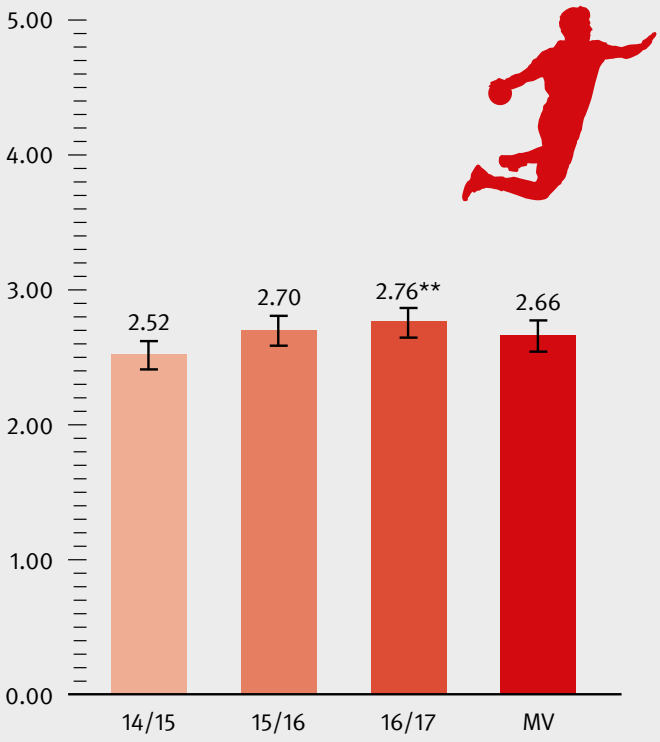
MV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2.76**
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14/15
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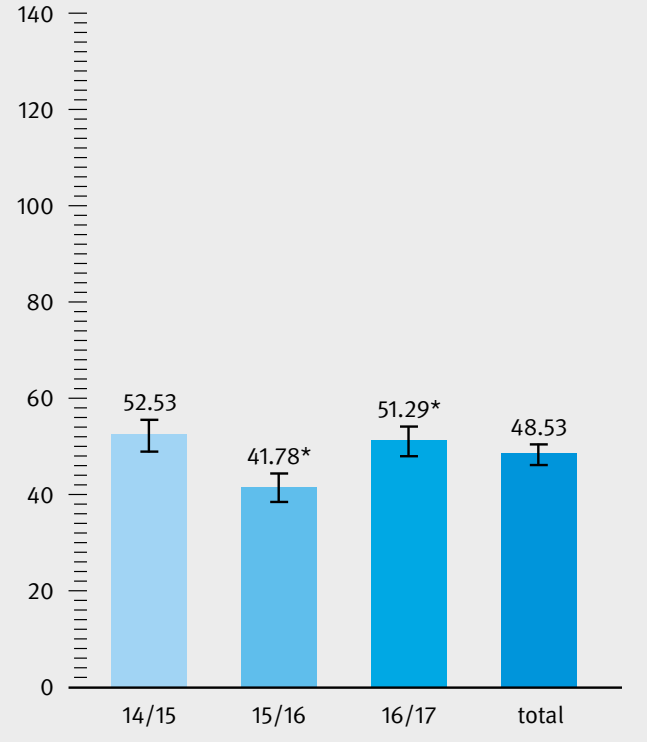
16/17
MV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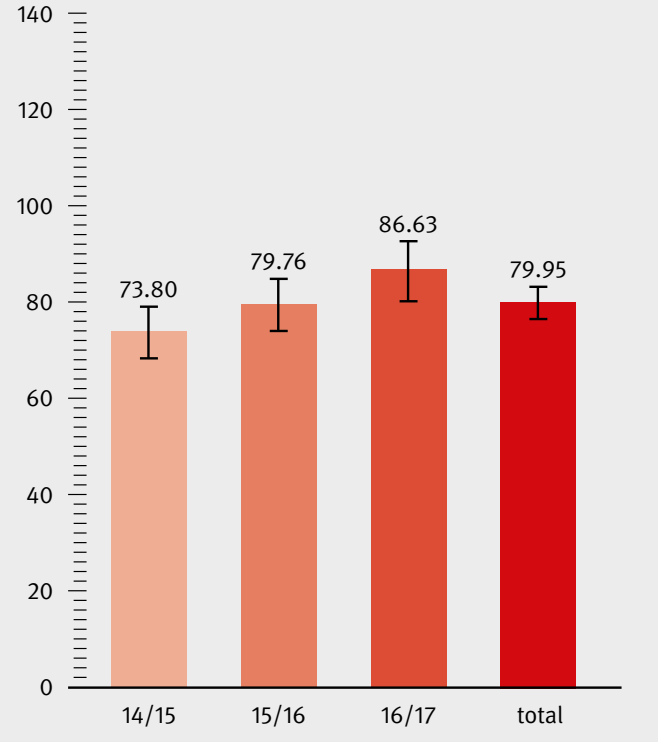
140
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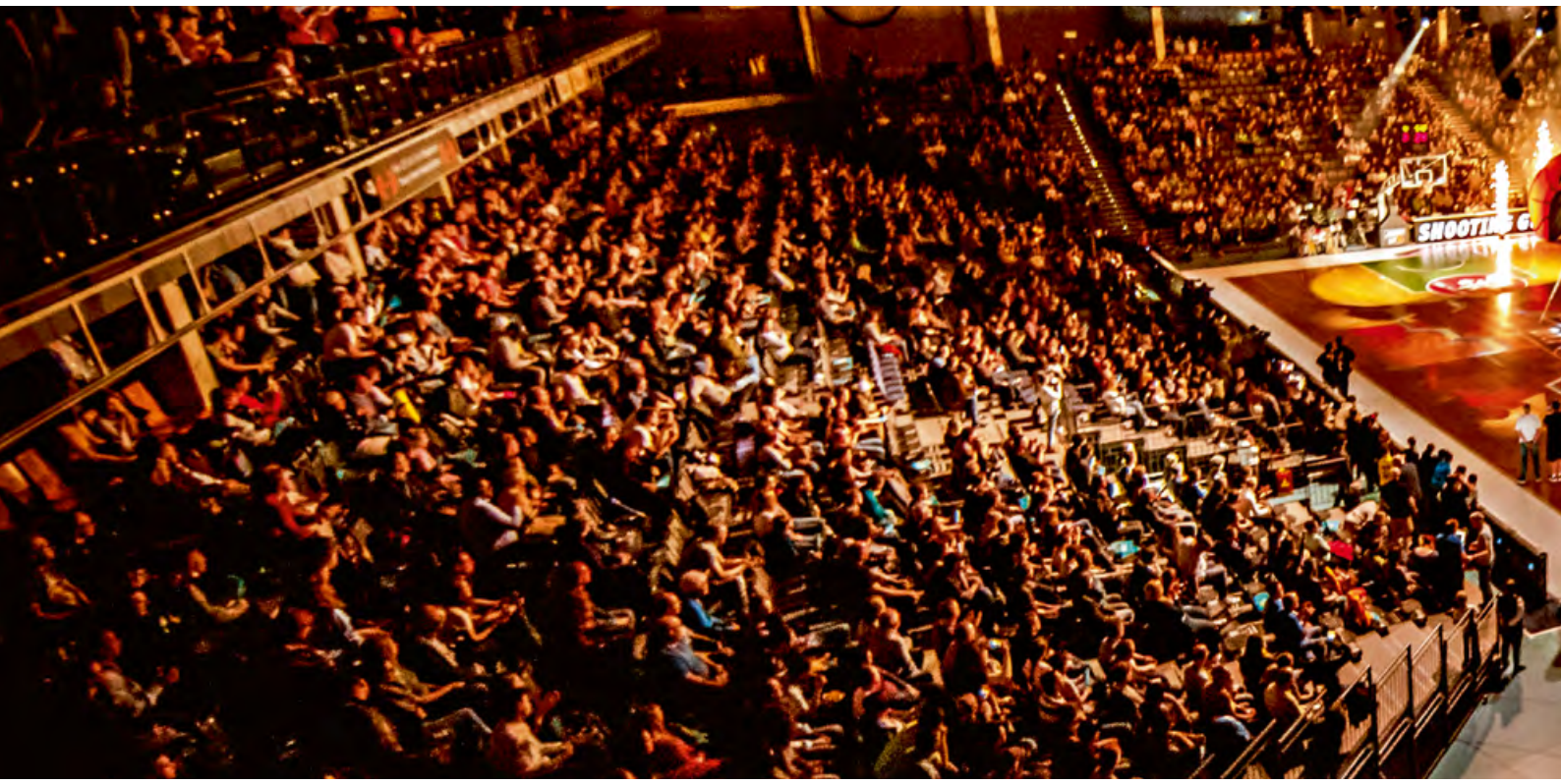
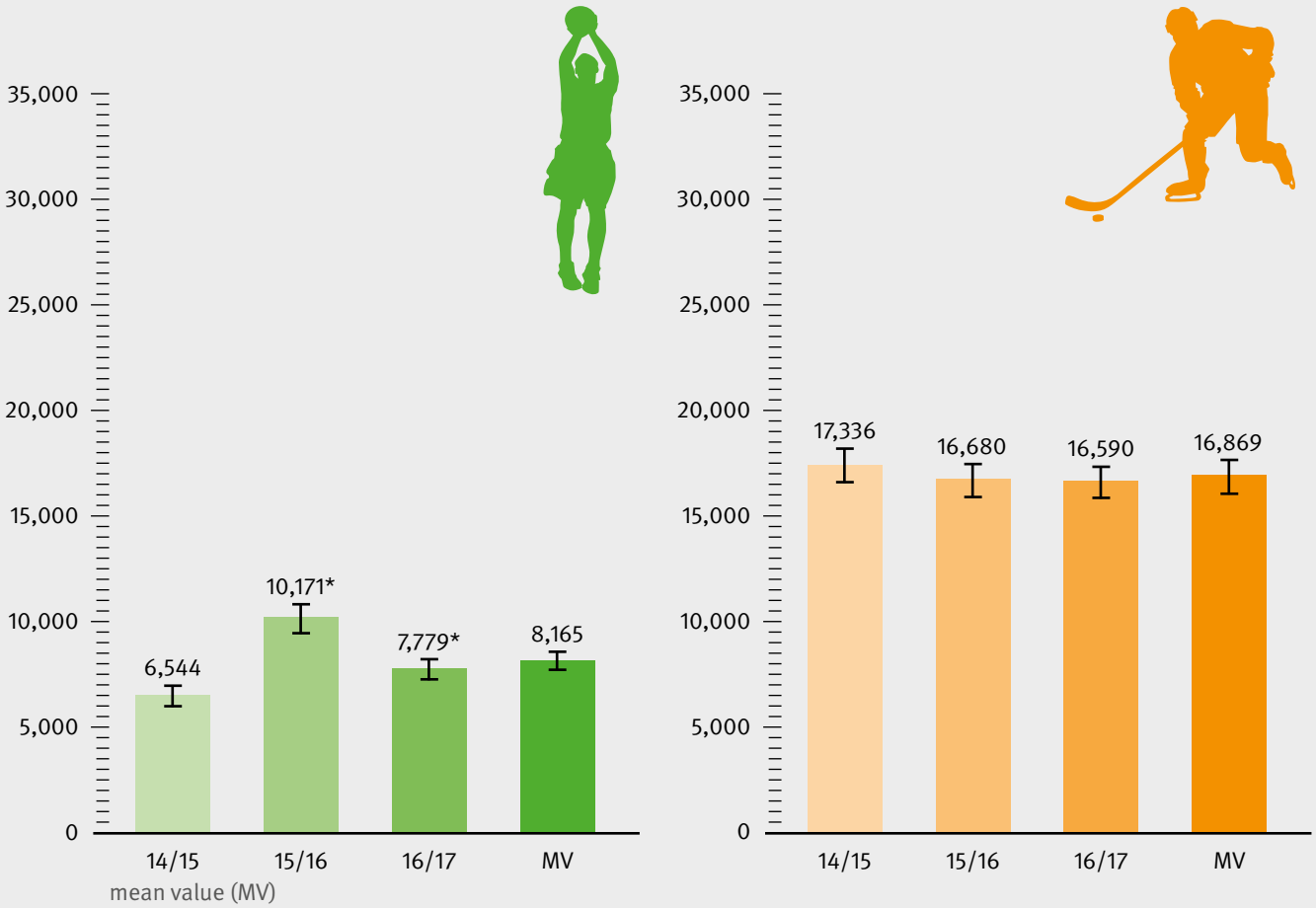


Injury burden

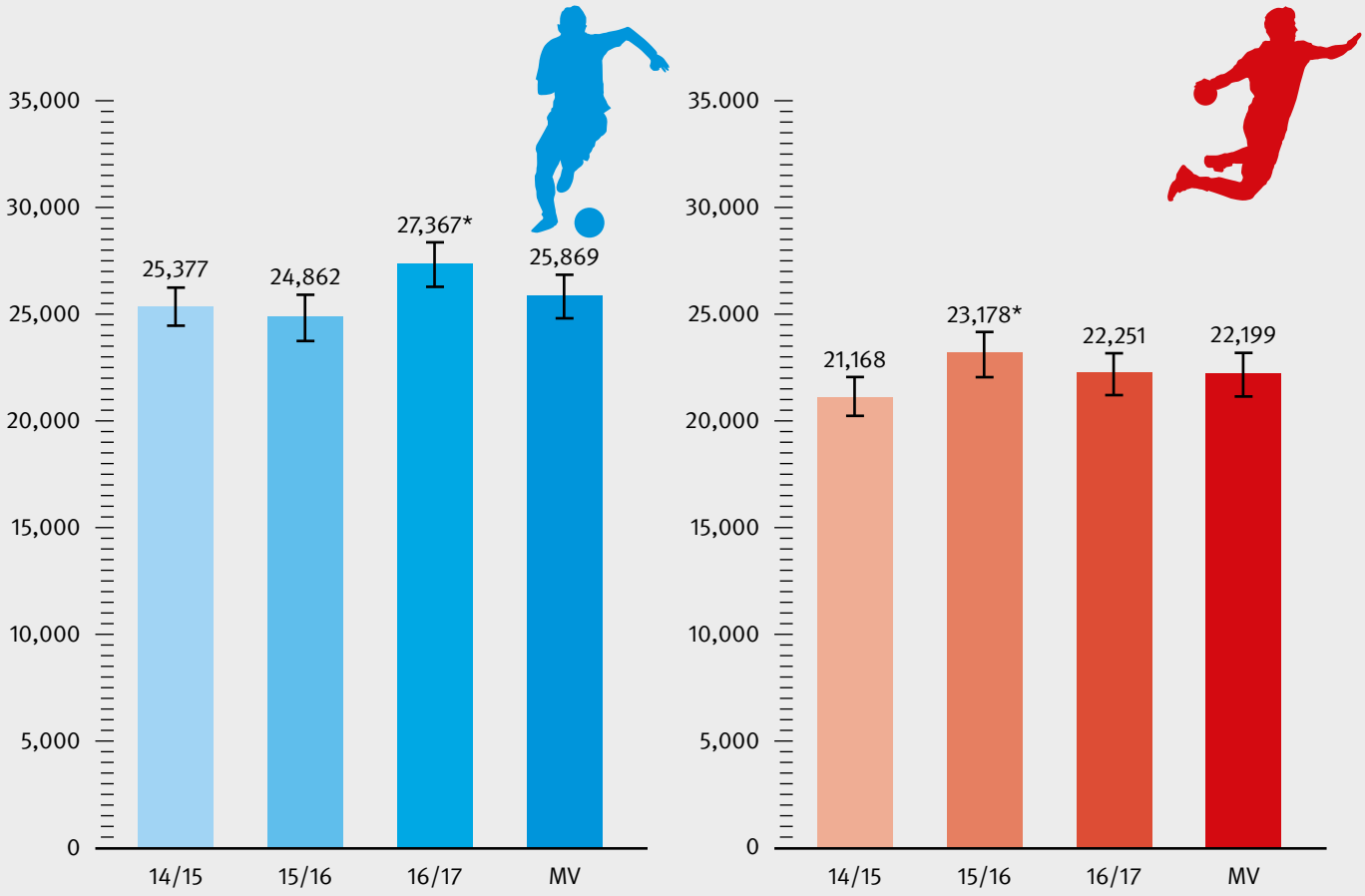
Number of days missed (n), season comparison (±95% confidence interval)



mean value (MV)

* Statistically significant difference compared to prior year

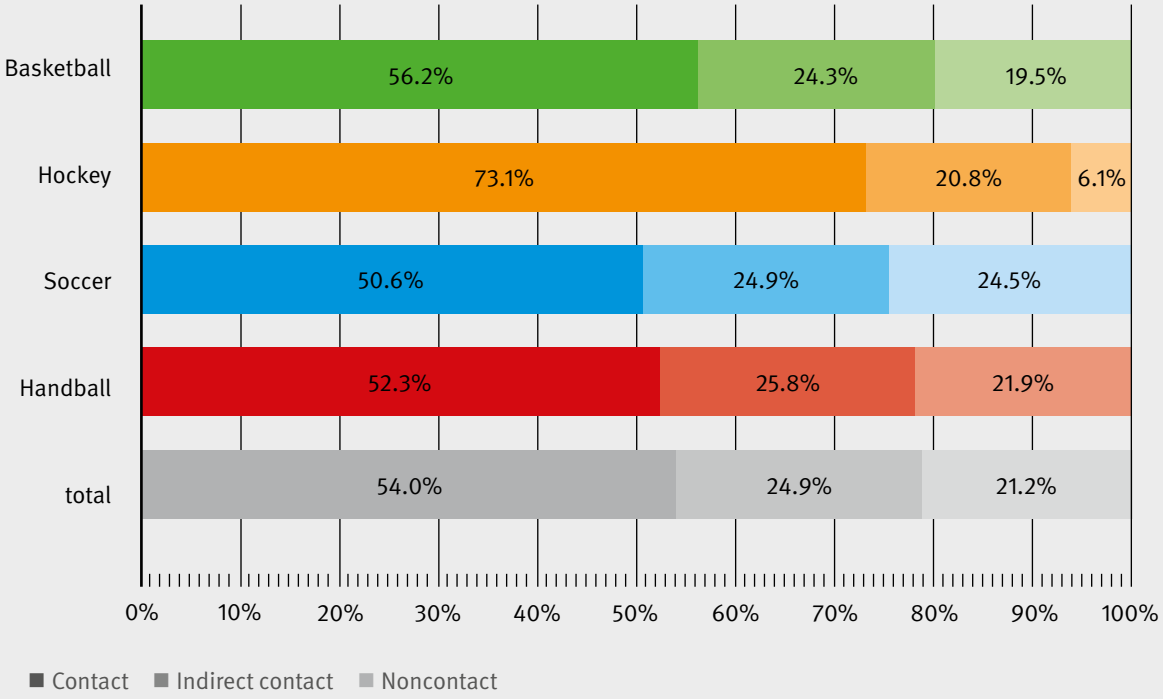

ANTHONY
Telekom Baskets Bonn
easyCredit-BBL.de


35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
25,377
24,862
27,367*
25,869
14/15
15/16
16/17
MV
35.000
30,000
25.000
20,000
15,000
10,000
5,000
0
21,168
23,178*
22,251
22,199
14/15
15/16
16/17
MV

5 Key issue – workload management

Injury mechanism* by sport

Proportion (%) of contact, indirect contact, and noncontact injuries



* Based on the video analysis of moderate and severe competitive injuries from 2010–2017 (n = 1,527)

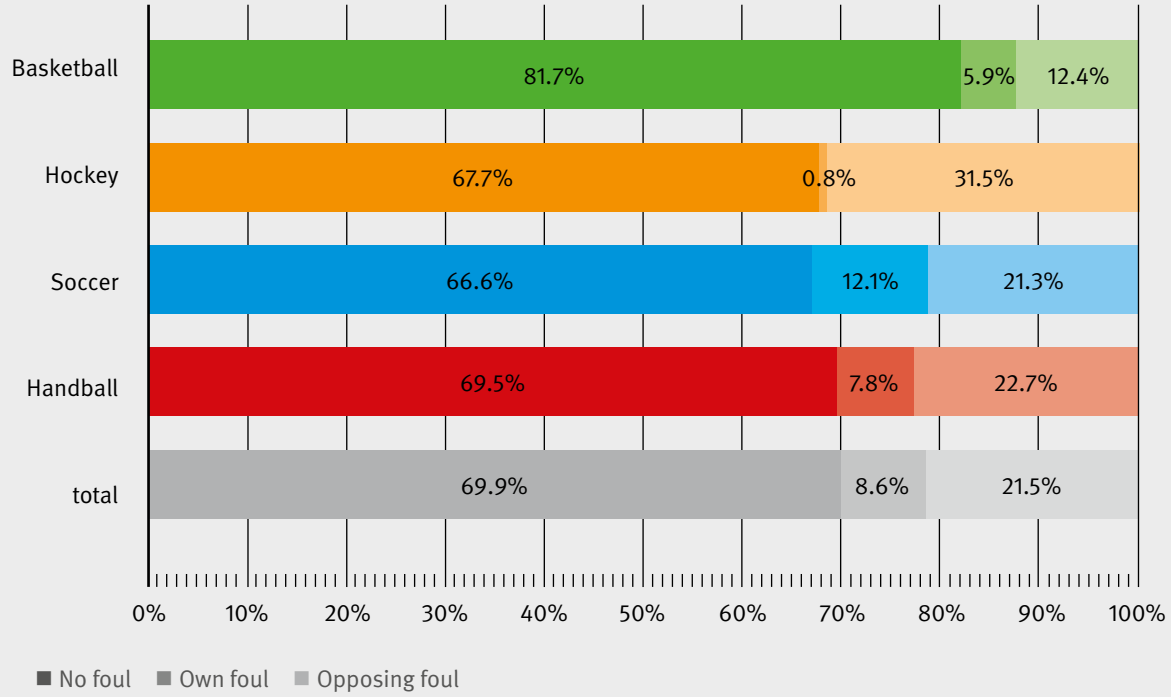
Only fresh, rested players can deliver maximum performance. Systematic training management and periodization, therefore, constitute the basis for a successful season. Ensuring an optimal balance between load and recovery is not easy, especially in view of increasingly busy competition calendars. If the balance between these two opposites is right, players can continuously improve their ability to perform and are in perfect condition when it counts. If, however, the load is too low, then they frequently remain below their capabilities and are unable to realize their full potential. Conversely, there is a risk of performance drop and injuries if the load is too high. Player availability in training and competition is a key success factor in sports[3, 4] because only healthy players have the opportunity for further development in training and matches.

3 Drew, M. K., Raysmith, B. P., & Charlton, P. C. (2017). Injuries impair the chance of successful performance by sportspeople: A systematic review. British Journal of Sports Medicine, 51(16), 1209–1214.

4 Hägglund, M., Waldén, M., Magnusson, H., Kristenson, K., Bengtsson, H., & Ekstrand, J. (2013). Injuries affect team performance negatively in professional football: An 11-year follow-up of the UEFA Champions League injury study. British Journal of Sports Medicine, 47(12), 738–742.

Foul as the cause of injury*,** by sport

Proportion (%) of injuries by no, own, and opposing foul



* Based on the video analysis of moderate and severe competitive injuries from 2010–2017 (n = 1,527)

** Official referee decision

Current studies and expert assessments[5, 6, 7] as well as the evaluations in this edition of the VBG Sports Report 2019 show that overload is one of the main risk factors for injuries. It is true that injuries are usually multifactorial and can rarely be clearly attributed to a single cause. The comparatively small proportion of injuries in which (opponent) contact plays a major role, or where the rules are in fact violated, does however indicate that the reasons for injuries are often found in other areas and are frequently of an intrinsic nature.

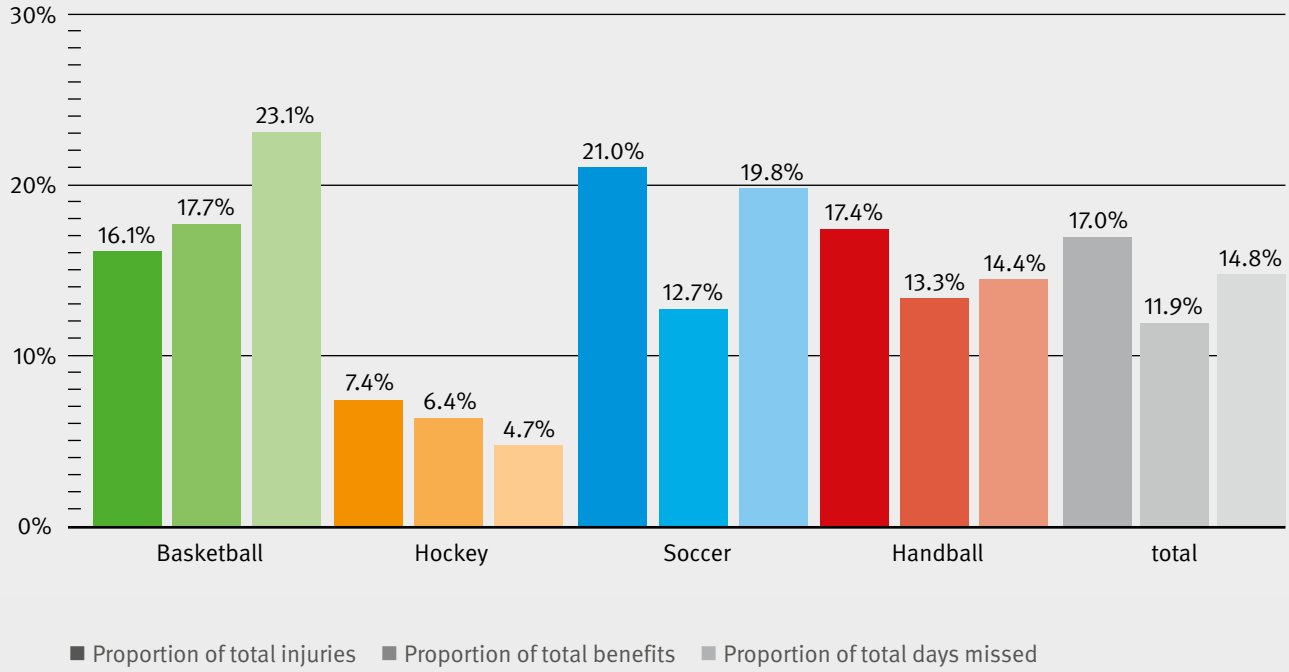
Injuries due to structural overload, for instance, account for 17% of all moderate and severe competitive injuries in the four sports examined by us. One-fifth of the days missed in soccer and fully one-quarter in basketball are due to injuries caused by structural overload. Since injuries sustained during training, where harsh or downright unfair conduct generally plays a minor role, could not be included in the video analyses that were carried out, the total proportion of all the injuries is presumably considerably higher. Furthermore, an overrepresentation of contact injuries can be presumed in the underlying video data set since these match scenarios are easier to identify in the videos.

5 Dvorak, J., Junge, A., Chomiak, J., Graf-Baumann, T.,Peterson, L., Rosch, D., & Hodgson, R. (2000). Risk factor analysis for injuries infootball players. Possibilities for a prevention program. The American Journal of SportsMedicine,28(5Suppl), 69–74.

6 Klein, C., Henke, T., Luig, P., & Platen, P. (2018). Leaving injury prevention theoretical? Ask the coach! – A survey of 1012 football coaches in Germany. German Journal of Exercise and Sport Research, 48(4), 489–497.

7 McCall, A., Carling, C., Nedelec, M., Davison, M., Le Gall, F., Berthoin, S., & Dupont, G. (2014). Risk factors, testing and preventative strategies for non-contact injuries in professional football: current perceptions and practices ofa 44 teams from various premier leagues. British Journal of Sports Medicine, 48(18),1352–1357.

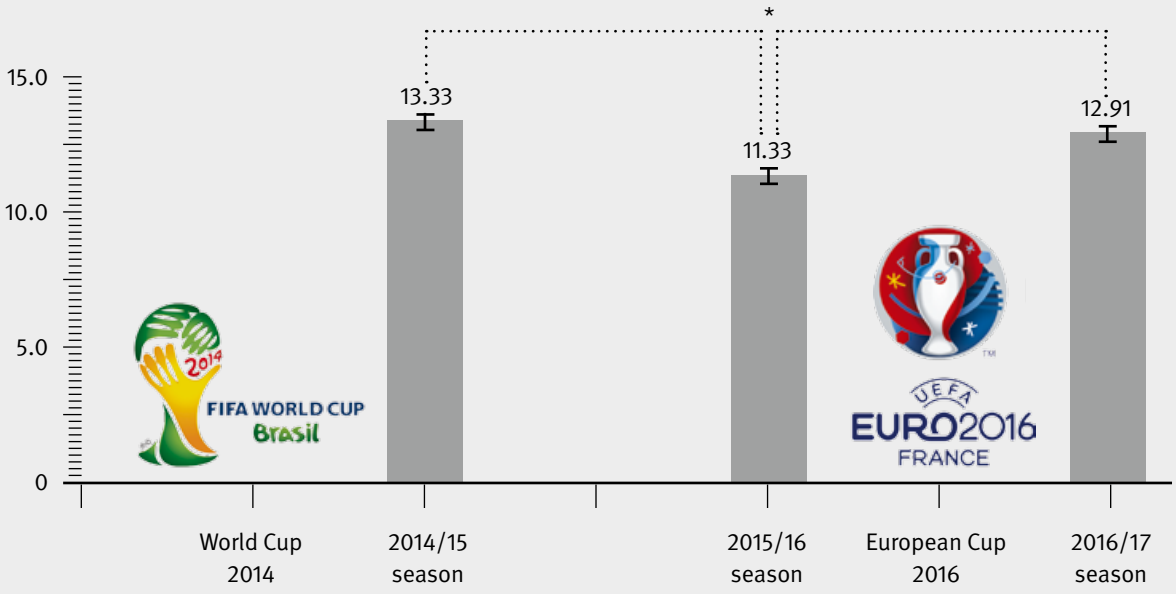
Injuries due to structural overload*



* Based on the video analysis of moderate and severe competitive injuries from 2010–2017 (n = 1,527)

Total incidence (±95% confidence interval) in soccer

Comparison of three consecutive seasons with and without an international tournament leading up to a season



* Statistically significant difference compared to 2014/15 and 2016/17

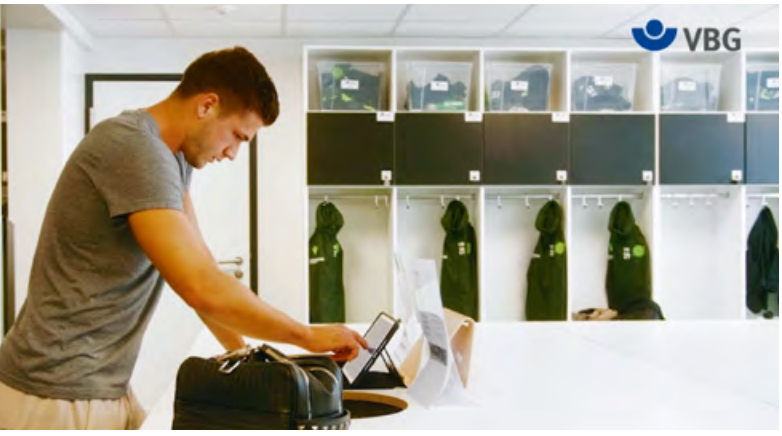
Statistically significant fluctuations in the season comparison can also serve as an indicator of the overload risk factor as a relevant cause for high injury rates. In soccer, for example, we identified a significantly higher season and league incidence in the first and third seasons compared to the second season during the observation period. Major tournaments—the 2014 FIFA World Cup in Brazil and the 2016 UEFA European Championship in France—leading up to the respective seasons, with the accompanying higher number of matches and a shorter summer break for numerous players, could serve as a reason to explain this.

Consequently, it is of tremendous importance from the perspective of prevention to adequately time and coordinate training and regeneration measures, especially in phases defined by a high competitive density and short regeneration time. Phases in which the workload size and intensities increase rapidly over a short time have also proven to be risky: these are, for example, the preparation phase after the summer break or the return to team training following an injury.

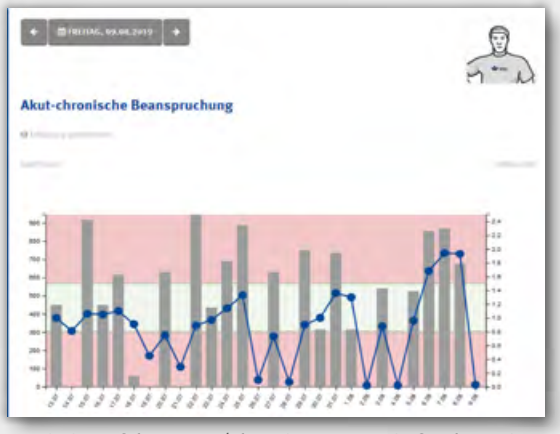
Knowledge of the players' individual recovery statuses and stress levels is therefore a basic prerequisite for a good management process for a trainer. Here, stress means the individual physical and mental fatigue at a certain point in time. The stress level depends on resilience and the current ability to perform, which means it can vary from one person to the next, even when the workload, meaning the actual objective performance, is the same. In team sports in particular, workload management based on individual stress conditions therefore constitutes an especially large challenge for the trainer teams. Their objective is to maintain an overview of the team structure and tactics, practice plays, and nevertheless challenge and support each player as individually as possible. We now want to assist you in this regard with the VBG Prevention Management Tool (PMT).

VBG Prevention Management Tool (PMT)

PMT Functions



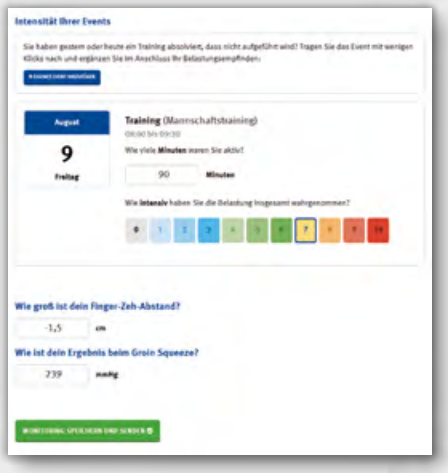
The PMT is a browser-based web app that runs on a PC, tablet, and smartphone. You can add the tool to your smartphone or tablet home screen as an icon, so it looks like any app from the store. In the PMT, you can select from a pool of more than 30 qualitative and quantitative monitoring choices that supplies you with information about your players' current stress conditions. These include simple inquiries (such as subjective well-being, Rate of Perceived Exertion (RPE), sleep duration), tests to determine constitution (such as body size, weight, proportion of body fat), motor tests (such as jump tests, groin squeeze test, finger-ground distance), and parameters to determine external load (such as running distance, number of sprints, number of kicks). The standard and limit values for all the monitoring options can be adapted to personal needs, and custom warning rules can be defined.



Depiction of the acute/chronic stress ratio for the trainer

Depiction of the dashboard—key information for the trainer at a glance

Depiction of the calendar function for the coordination of events such as training units, matches, and trips



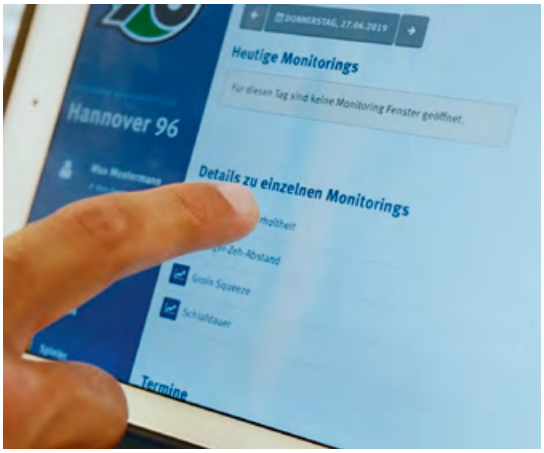
Depiction of the monitoring inquiries at the player level

http://www.vbg.de/pmt

First steps in the PMT

We have generated a test dataset intended to help you quickly familiarize yourself with the PMT and learn about its functions. If you want to use the tool in your team, you should first set up the team. Then, you should set up the members of the support team who will also have access to the tool. You can grant them access to all or only certain teams. In the next step, you or your team members can set up players and assign them to the corresponding teams. Next, you enter your training units and matches using the calendar function, and then monitoring can begin.

Before and after training, players can easily enter their information using a smartphone or, alternatively, the PMT's locker room mode using a tablet in the locker room. You can select and deselect monitoring options in the settings. The warning rules for each monitoring option can also be adapted to your personal needs. Rules that define what monitoring inquiries to issue and when (for example, every day or on the



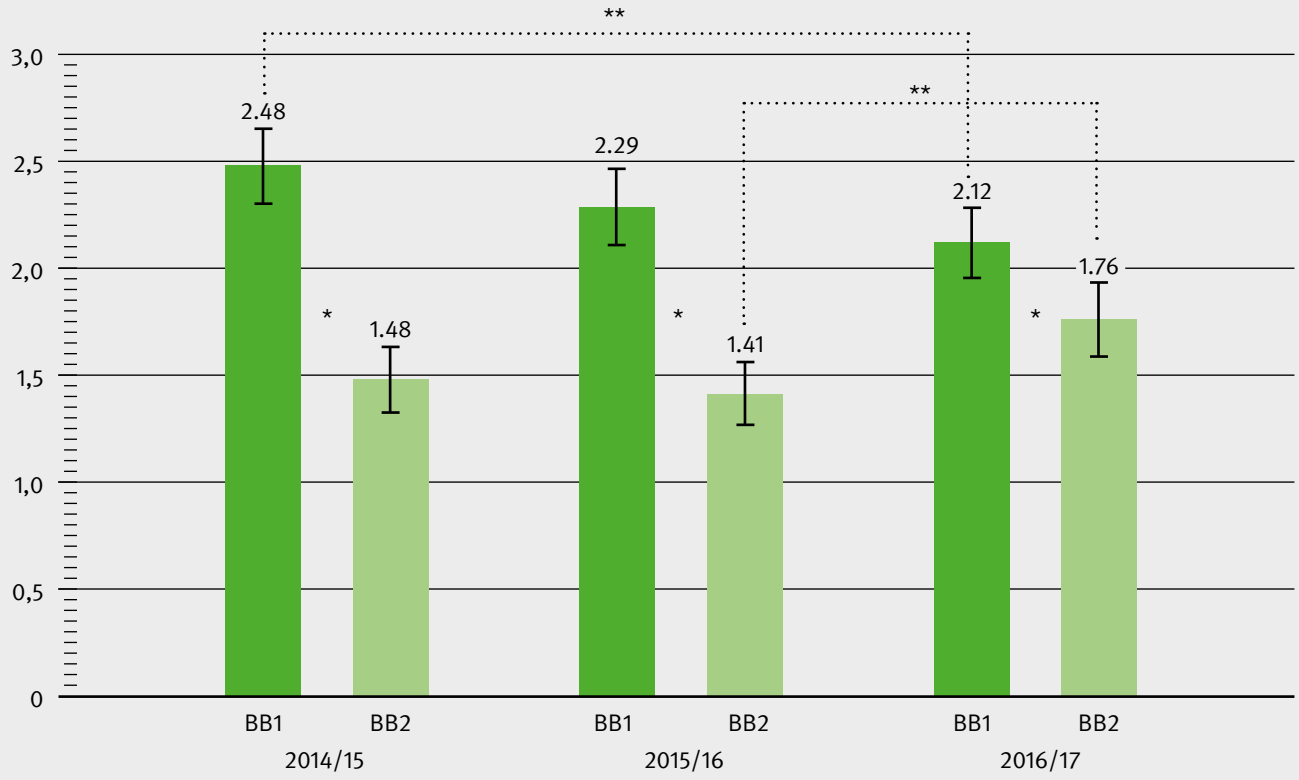
day of an event) can be adapted to your needs as well. To make the launch easier we have configured basic settings, so you can start right away.

6 Injuries in basketball

Basketball

Cumulative season incidence by league and season

2014/15, 2015/16, and 2016/17 seasons (n = 3,047); ±95% confidence interval



* Statistically significant difference in league comparison
** Statistically significant difference in season comparison

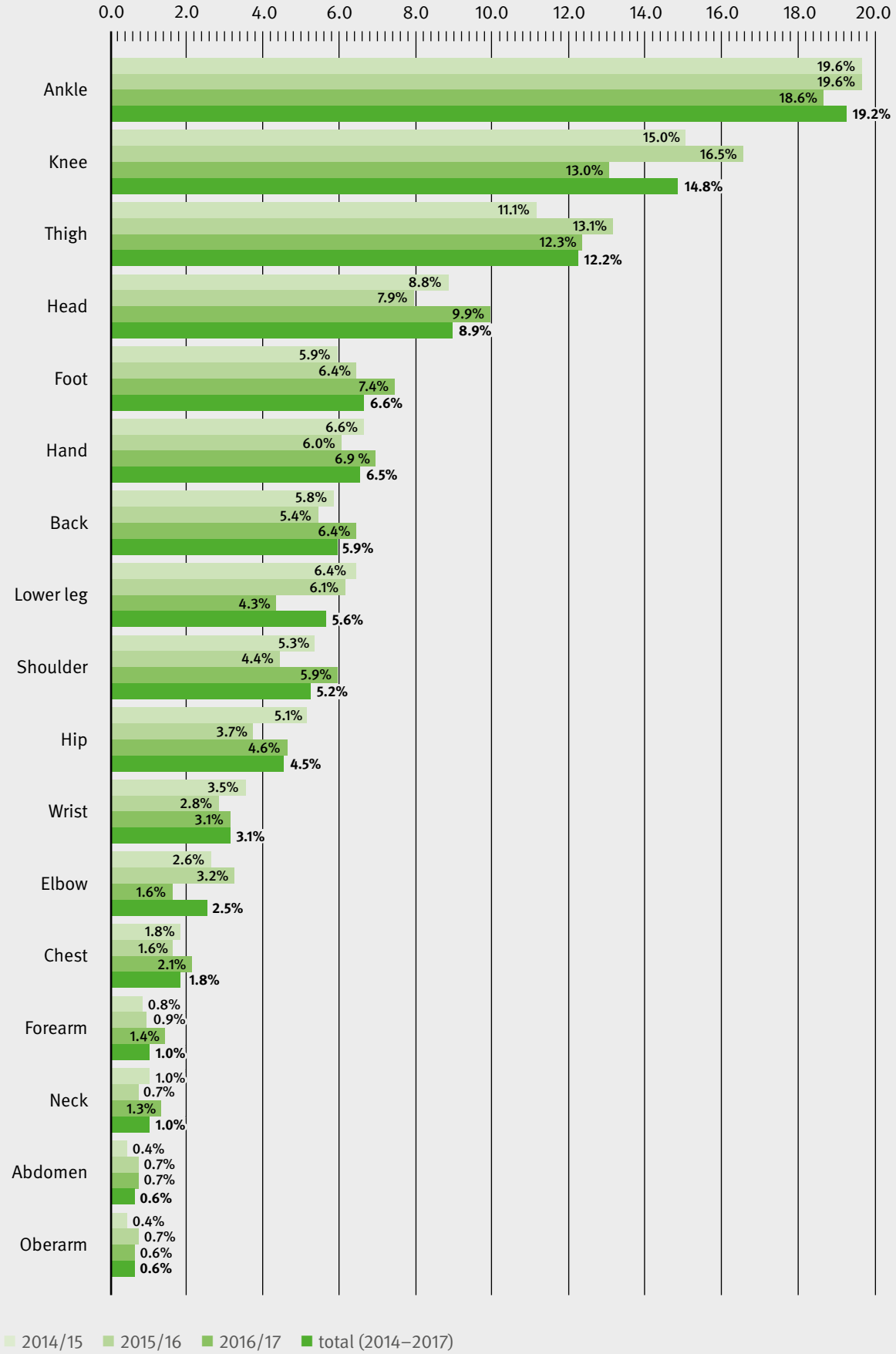
In the examination of injuries in the 2014/15, 2015/16, and 2016/17 seasons, a total of 3,047 injuries were recorded in the top two men's basketball leagues. These are divided into 1,964 injuries in BB1 compared to 1,083 injuries in BB2.

This results in cumulative season incidences of 1.55 injuries per player and season in BB2 compared to a significantly higher injury frequency of 2.30 injuries per player in BB1. Thus, the observation of previous editions of the VBG Sports Report that the injury frequency is considerably higher in BB1 than in BB2 is confirmed. The number of official matches, which is considerably higher on average in BB1 than BB2 due to European competitions, could be one reason for this. However, the longitudinal study shows that the spread between the two leagues is narrowing. While the average injury rate in BB1 has dropped continuously and significantly from 2.48 to 2.12 in the three seasons under review, the injury rate in BB2 increased to 1.76 injuries per player and season in the 2016/17 season.

»BB1 has significantly higher incidence rates than BB2 in all three seasons.«

Distribution of injuries by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 3,047)



Basketball

It is, however, evident in both leagues that basketball players, at less than two injuries per season, are injured considerably less often compared to players of the other team sports. The cumulative season incidences in hockey, soccer, and handball are between 2.5 and 2.7 injuries per player and season.

Notwithstanding these comparatively low cumulative season incidences, an overall view of all four sports shows that basketball takes second place after hockey in an examination of the league incidences (122 injuries per 1,000 league match hours). On average, around 95 injuries per 1,000 league match hours occurred in basketball. This value is about 10 injuries above the average for all four sports and exceeds the league incidences in soccer by a factor of 2.

An explanation lies in the difference in the four sports' gross/net play time. In basketball, comparable to hockey and handball, the gross and net play times are nearly identical, while the gross and net play times deviate considerably from each other in soccer. Another reason for an increased risk of injury in league matches might be found in the frequent, short-term player changes with an associated lack of warm-up phases.

The total days missed increased significantly in the 2015/16 season compared to the previous and subsequent seasons. At first glance, this development seems remarkable since the prevalences and cumulative season incidences in this season actually decreased slightly. A closer look at the data shows that the increase in total days missed was mainly caused by an enormous increase in BB2, where the days missed nearly doubled compared to the prior year. This result is due to comparatively few but very serious injuries, with a considerable increase in days missed. For prevention, this leads to the insight that preventing even a few but highly relevant injuries can lead to considerable and readily noticeable relief for the teams.

»In a comparison of the four sports, basketball exhibits lower prevalences, cumulative season incidences, and total days missed but comparatively high league incidences.«

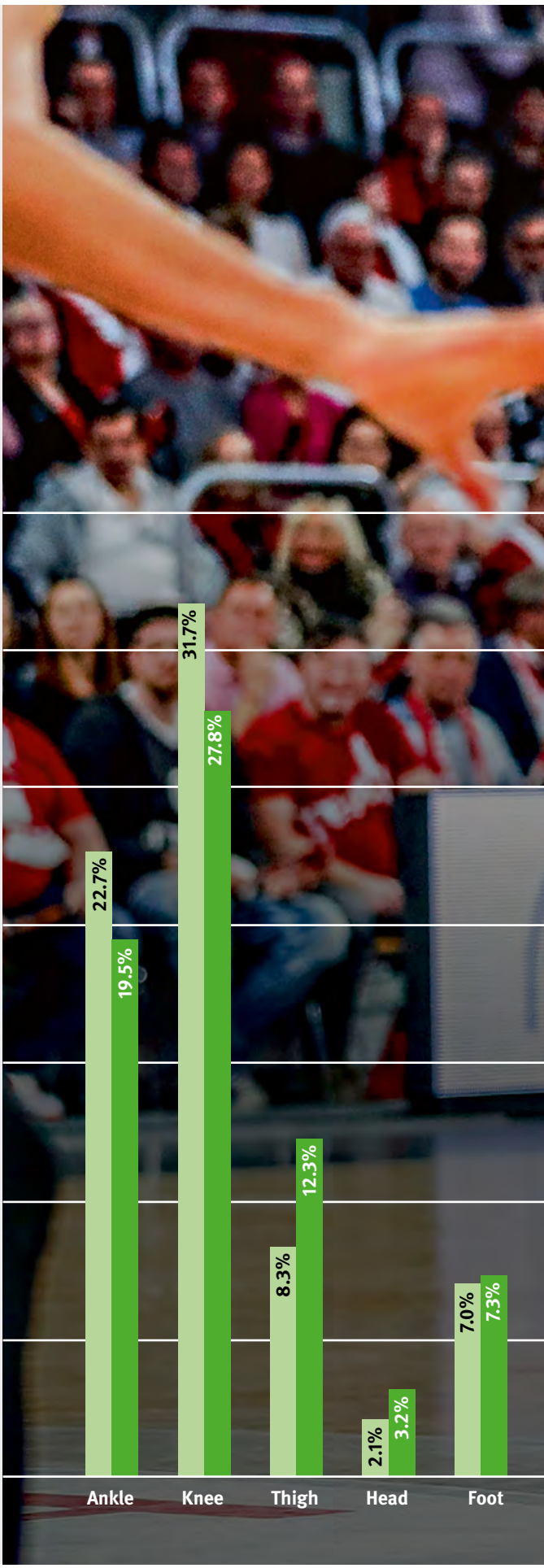
Downtime and costs by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 3,047)

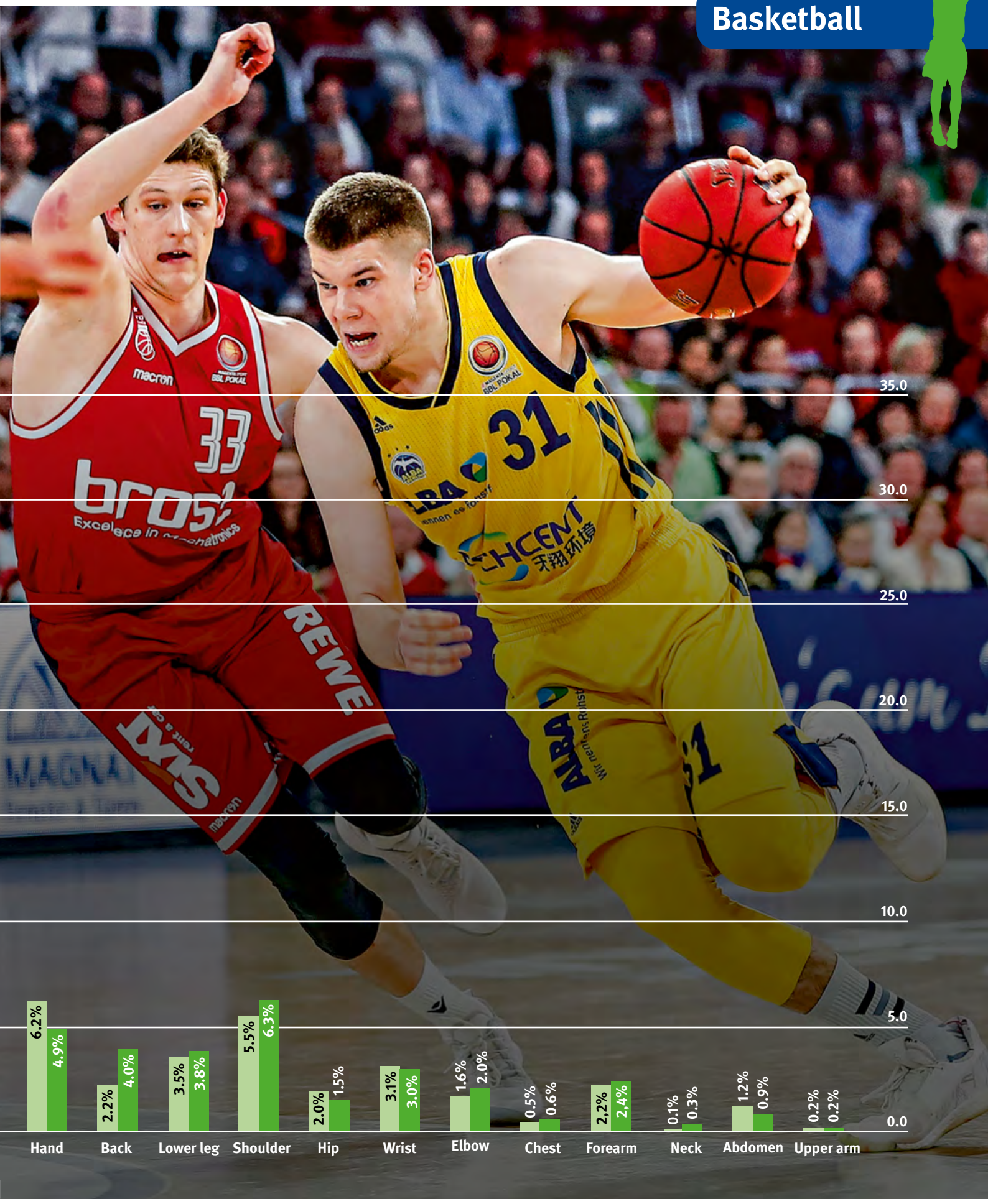
To establish a benchmark for the two examined leagues that permits a comparison of the teams within a league, we decided to calculate the relative injury burden.

This is the sum of all the days missed divided by the number of official matches for each team. To exclude the risk of bias due to different reporting behavior in this calculation, only injuries subject to mandatory reporting (≥ 4 days missed) were included in calculating the relative injury burden.

»The ankle is most frequently affected, but knee injuries result in the most days missed and the highest benefits.«

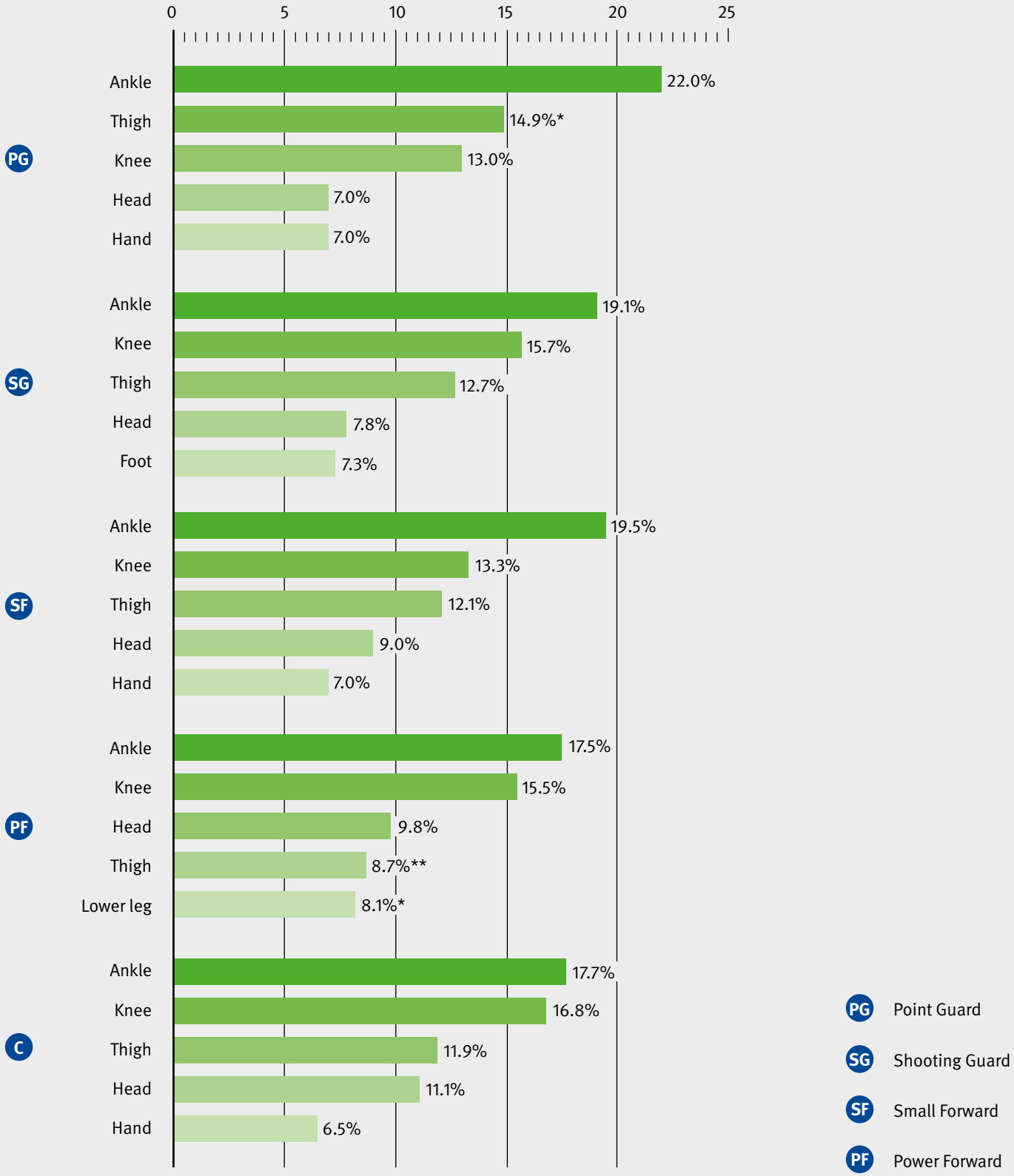


Basketball


35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
6.2%
4.9%
2.2%
4.0%
3.5%
3.8%
5.5%
6.3%
2.0%
1.5%
3.1%
3.0%
1.6%
2.0%
0.5%
0.6%
2,2%
2,4%
0.1%
0.3%
1.2%
0.9%
0.2%
0.2%
Hand
Back
Lower leg
Shoulder
Hip
Wrist
Elbow
Chest
Forearm
Neck
Abdomen
Upper arm

Top 5 body regions by playing position

2014/15, 2015/16, and 2016/17 seasons (n = 3,047)[8]



* Overrepresented compared to the group as a whole | ** Underrepresented compared to the group as a whole

8 The assignment of playing positions was taken from the websites https://www.easycredit-bbl.de and https://www.2basketballbundesliga.de after the end of the respective season.

Basketball

In BB1 and BB2, 508 and 289 injuries subject to mandatory reporting were recorded, respectively. The spread between the teams differed considerably. BB1 teams had between 3 and 35 injuries subject to mandatory reporting per season, leading to a total downtime of 32 to 756 days missed within a season. Two teams in BB2 completed the 2016/17 season without a single injury subject to mandatory reporting, while other teams had up to 17 injuries, with at least 4 days missed. Due to some very severe injuries, the downtime for one BB2 team adds up to more than 2,000 days within one season in the observation period, corresponding to approximately 5.5 years of incapacity for work.

Putting this into perspective in relation to the number of official matches, the average burden for BB1 over the three seasons is 5.5 to 7.4 days missed per official match, with the team having the worst standing reaching values, which are about 13 to 20 times higher than those of the team with the lowest relative injury burden.

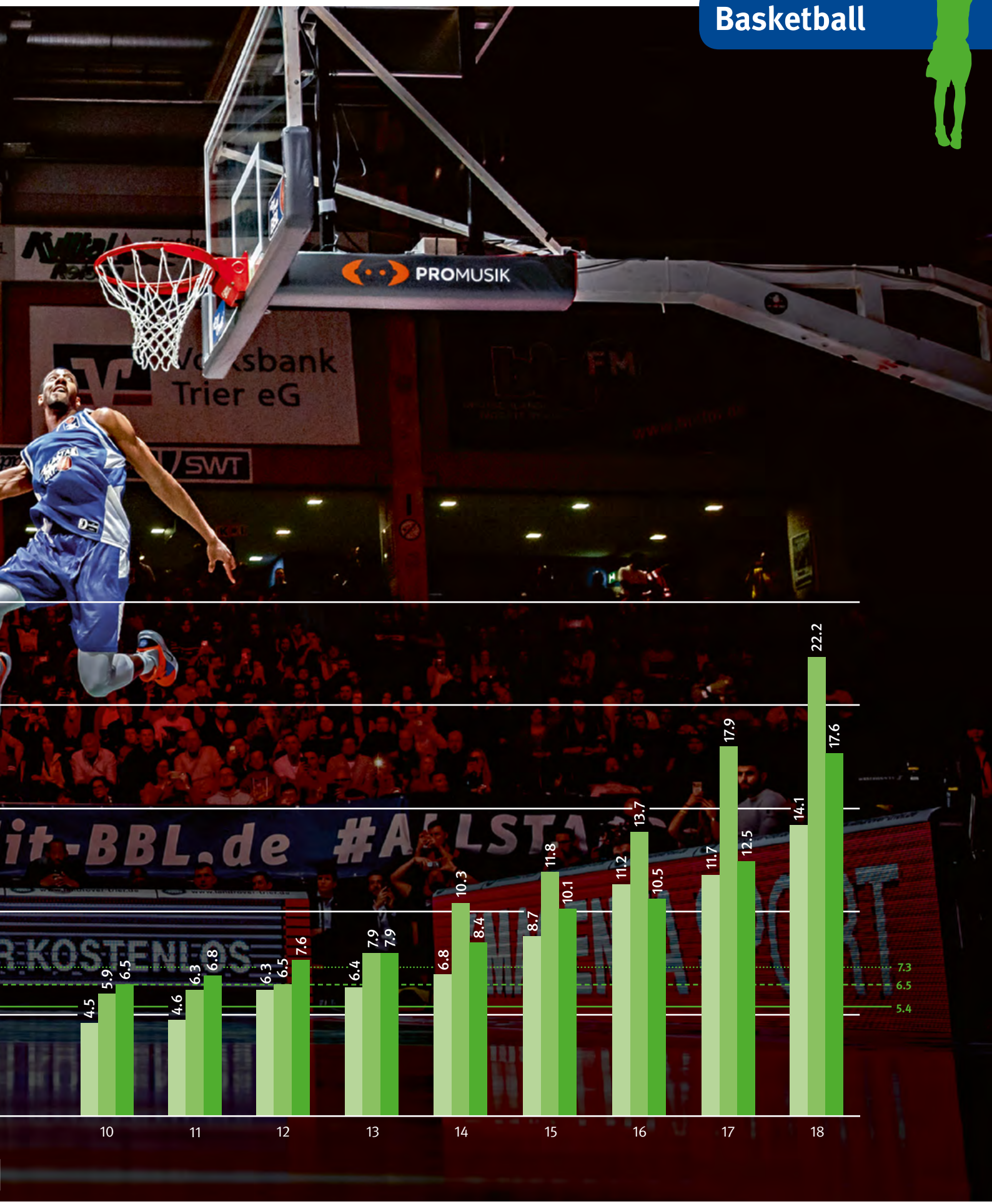
In BB2, the average values are between 4.0 and 8.2 days missed per official match, with a spread of 0 to almost 60 days missed per official match between teams 1 and 16. Examining these enormous spreads between teams within the same league indicates just how great the potential for injury reduction may be. Evidently, the challenging conditions of professional basketball do allow for making it through a season without moderate, let alone severe, injuries.

»Two teams in BB2 made it through an entire season without a single injury subject to mandatory reporting.«

Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

BB1, 2014/15, 2015/16, and 2016/17 seasons (n = 508)

Basketball


PROMUSIK
Volksbank Trier eG
SWT
it-BBL.de
4.5
5.9
6.5
4.6
6.3
6.8
6.3
6.5
7.6
6.4
7.9
7.9
6.8
10.3
8.4
8.7
11.8
10.1
11.2
13.7
10.5
11.7
17.9
12.5
14.1
22.2
17.6
7.3
6.5
5.4
10
11
12
13
14
15
16
17
18

Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

BB2, 2014/15, 2015/16, and 2016/17 seasons (n = 289)

Basketball


4.0
4.8
3.3
4.0
5.0
4.7
5.0
5.3
6.4
5.2
6.1
6.9
6.2
7.4
9.1
6.8
8.0
15.0
7.4
16.5
15.8
8.4
16.0
8.1
5.4
4.0
9
10
11
12
13
14
15
16

Key insights and lessons learned for prevention

Apparently, a higher density of play is accompanied by an increased risk of injury.

- The busier the competition schedule, the more important individual workload management for the players becomes.

»There are considerable differences in the relative injury burden between teams within the same league.«

Basketball

Ankle, knee, thigh, and foot injuries cause about 70% of the downtime and benefits.

- These four body regions should be prioritized in the development and implementation of preventive measures as well as in return-to-competition guidelines.

The large spread of injuries subject to mandatory reporting, with the resulting days missed in the team comparison within the respective league, indicates enormous prevention potential.

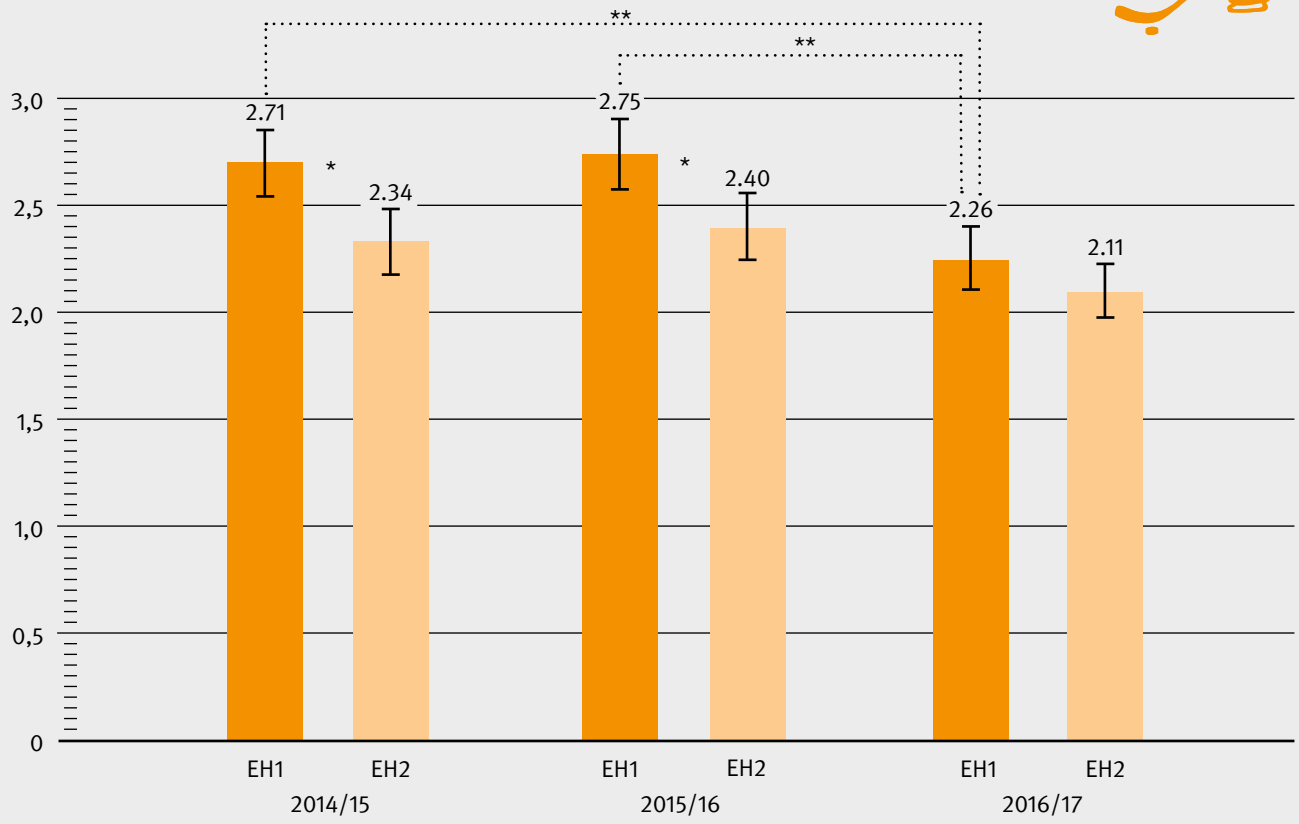
- The qualitative and quantitative training science, medical, and physiotherapy care provided to the players appears to vary considerably between teams.

7 Injuries in hockey

Hockey

Cumulative season incidence by league and season

2014/15, 2015/16, and 2016/17 seasons (n = 3,047); ±95% confidence interval



* Statistically significant difference in season comparison
** Statistically significant difference in league comparison

As shown in the sports comparison chapter, the risk of injury in hockey—especially in competition as opposed to practice—is significantly increased. Hockey has by far the highest league incidence of injury: 2.5 times higher than in soccer. However, if we look at the cumulative seasonal incidence of injury and the sum of the days lost to injury by players, hockey ranks behind soccer and handball in a longitudinal analysis.

Looking at the three consecutive seasons, there is a clear decline in the cumulative seasonal incidence of injury for 2016/17. In particular, a significant decline can be seen compared to the previous 2015/16 season. This presumably also leads to a decline in the number of days of incapacity to work (AU), even if this difference is only a trend and is not statistically significant.

Comparing the two hockey leagues, injury rates in the 2014/15 and 2015/16 seasons were always higher in EH1 than in EH2. However, this phenomenon was no longer observed in the 2016/17 season, mainly due to the significant decline in seasonal incidents in EH1.

Since on average the teams in EH1 and EH2 play approximately the same number of official matches, the different personnel and technical conditions in the league comparison can be considered as a possible explanation. There seems to be some catching up to do in EH2.

»The risk of injury in hockey is by far the highest in competition.«

A further explanation of the different injury rates may be found in the fact that EH1 teams are regularly alerted to the issue of injury prevention by league officials. The basis for this is the VBG's provision of aggregated data on the teams' injury incidence as well as joint projects within the framework of a prevention agreement between EH1 and the VBG. This agreement was also recently reached with EH2 but cannot yet be taken into account when considering the three seasons.

A further indication that EH1 teams are increasingly considering injury-prevention issues and developing internal team injury prevention policies is the awarding of the Augsburg Panthers with the Sports Prevention Prize, which is awarded by the VBG every two years. This was the first time that an applicant from the sport of hockey was able to prevail with his concept over representatives of other sports.

»The cumulative season incidences have fallen in the longitudinal view.«

Hockey

Gemeinsam
Prävention entwickeln

VBG Next

With the aim of having as many healthy players as possible for their matches, the Augsburg Panthers are successfully dealing with the issues of preventive training and intervention (information about the Augsburg Panthers' prevention policy can be found at www.vbgnext.de/profitieren/?id=86).

Do you also have a good idea or an implemented project to improve health protection and occupational safety in your sports team? If so, then submit your idea or project to us.

Suitable topics include, for example:

- Preventive training management
- Sports psychology support
- Club management committed to extensive prevention measures and exemplary fair play
- Recording athletes' state of health and the resulting training management, also applicable after a sports injury to avoid recurrence

Submitted ideas and projects are automatically entered to win the VBG's next Sports Prevention Prize award. It is possible to win up to EUR 15,000 in prize money for each submission. The VBG also publishes excellent ideas or implemented projects in a database.

An independent jury comprised of VBG self-administration representatives and external personalities evaluates all submissions according to the following criteria:

1. Effectiveness, if the measure has already been implemented
Is the measure as successful as planned?

2. Innovativeness and future viability
How new is the measure? Is the measure being applied for the first time? To what extent is the measure creative and progressive in the interest of prevention? What is the measure's future viability?

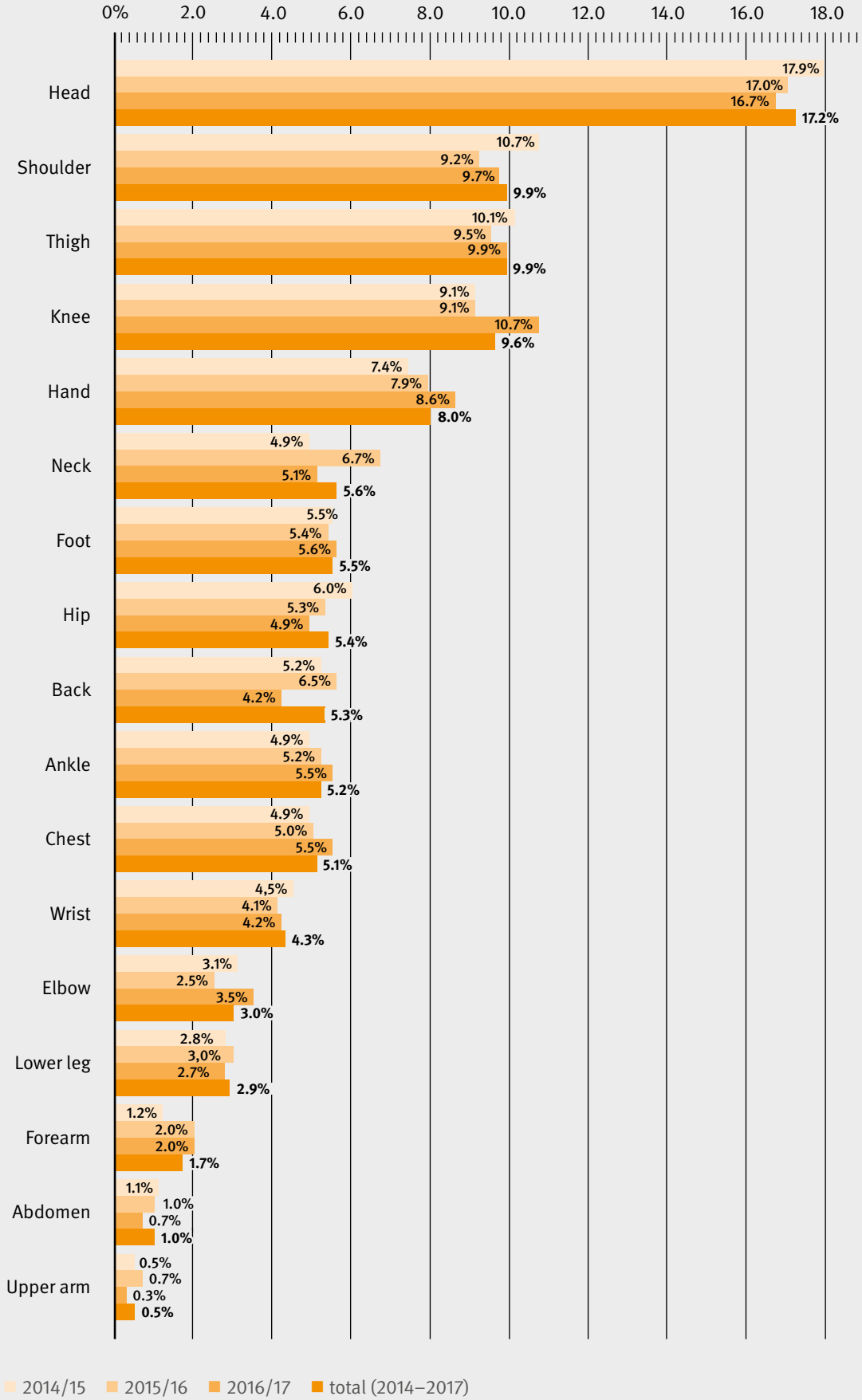
3. Economic viability
Is the measure economical? Does the measure contribute to cost reduction in the organization (time missed, lost production, more efficient operation, productivity)?

4. Applicability and transferability
Are other organizations motivated to implement this measure? Is the measure applicable for other organizations (practicality, usability for other sizes and types of organizations)? How sustainable is the measure?

https://www.vbgnext.de

Distribution of injuries by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 3,047)



Hockey

Almost every sixth injury in professional hockey involves the head. Although a significant decline in head injuries (-22%) can be observed in the longitudinal analysis, head injuries still represent by far the greatest problem when considering the distribution of injuries to different parts of the body over the three seasons.

Shoulder, thigh, and knee-joint injuries follow almost equally. As with head injuries, there is also a decline in shoulder (-25%) and thigh (-18%) injuries. Although the proportion of knee-joint and hand injuries has increased over the three seasons, the absolute numbers have remained almost constant and fluctuate only marginally between seasons.

However, the distribution of injuries to the individual body regions cannot be applied equally to all playing positions. It can be seen that the individual positions' requirement profiles have an influence on the occurrence of injuries: for example, goalies suffered significantly more thigh and knee-joint injuries (16.0% each) but were underrepresented in head injuries (10.7%). This may be due to the goalies' position-typical movement requirements, such as the butterfly technique, wide slides, or the crouching position. Conversely, goalies are much less frequently involved in contact situations with the board or with teammates and opponents.

Centers, on the other hand, suffer significantly more head injuries (20.2%) compared to the other playing positions. Due to their position, however, they also enter highly dynamic duel situations more often, with an increased risk of an opponent's body check or collision.

If, in addition to the pure frequency of incidents of injury, absence times and level of performance are also considered indicators of the possible severity of injuries, then shoulder and knee-joint injuries in particular crystallize as the central injury focal points in hockey in addition to head injuries. Of all the AU days, 21% can be attributed to injuries to the knee joint alone, while almost a quarter (23.3%) of the absences are caused by shoulder injuries. If one adds up the AU days of the three injury hot spots mentioned, they are responsible for almost half (49.3%) of the incapacity to work in hockey.

Since head and shoulder injuries are often caused by head–board or shoulder–board collisions, the mandatory introduction of load-reducing boards in the EH1 in the 2020/21 season is welcome from a preventive perspective. Scientific studies have shown that the risk of injury can be reduced by up to 29% with load-reducing boards.[9]

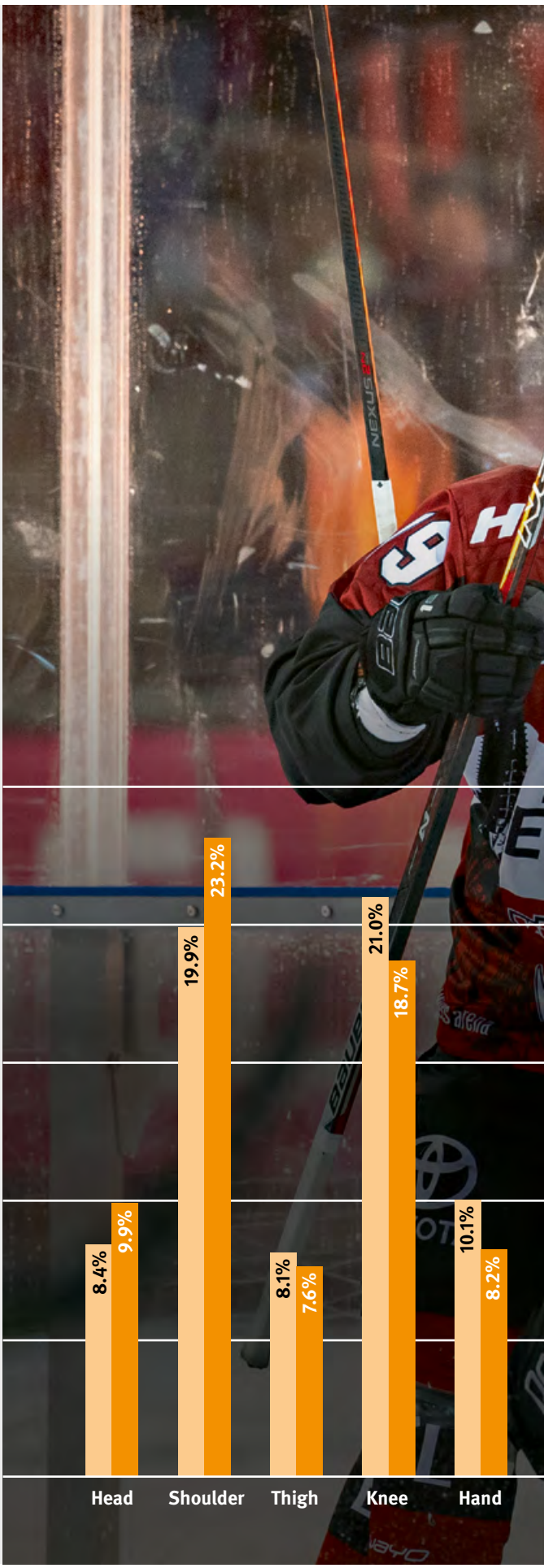
The long inactive period and high risk of reinjury for knee-joint and shoulder injuries, as well as the higher general risk of injury after a concussion, also highlight the need to implement return-to-play guidelines.

»Head, shoulder, and knee injuries are the top 3 injury hot spots in hockey.«

9 Tuominen, M., Stuart M.J., Aubry, M., Kannus, P., Parkkari, J. (2015). Injuries in men's international ice hockey: a 7-year study of the International Ice Hockey Federation Adult World Championship Tournaments and Olympic Winter Games. British Journal of Sports Medicine. 49, 30-36.

Downtime and costs by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 5,641)



»There are considerable differences in the relative injury burden between teams within the same league.«

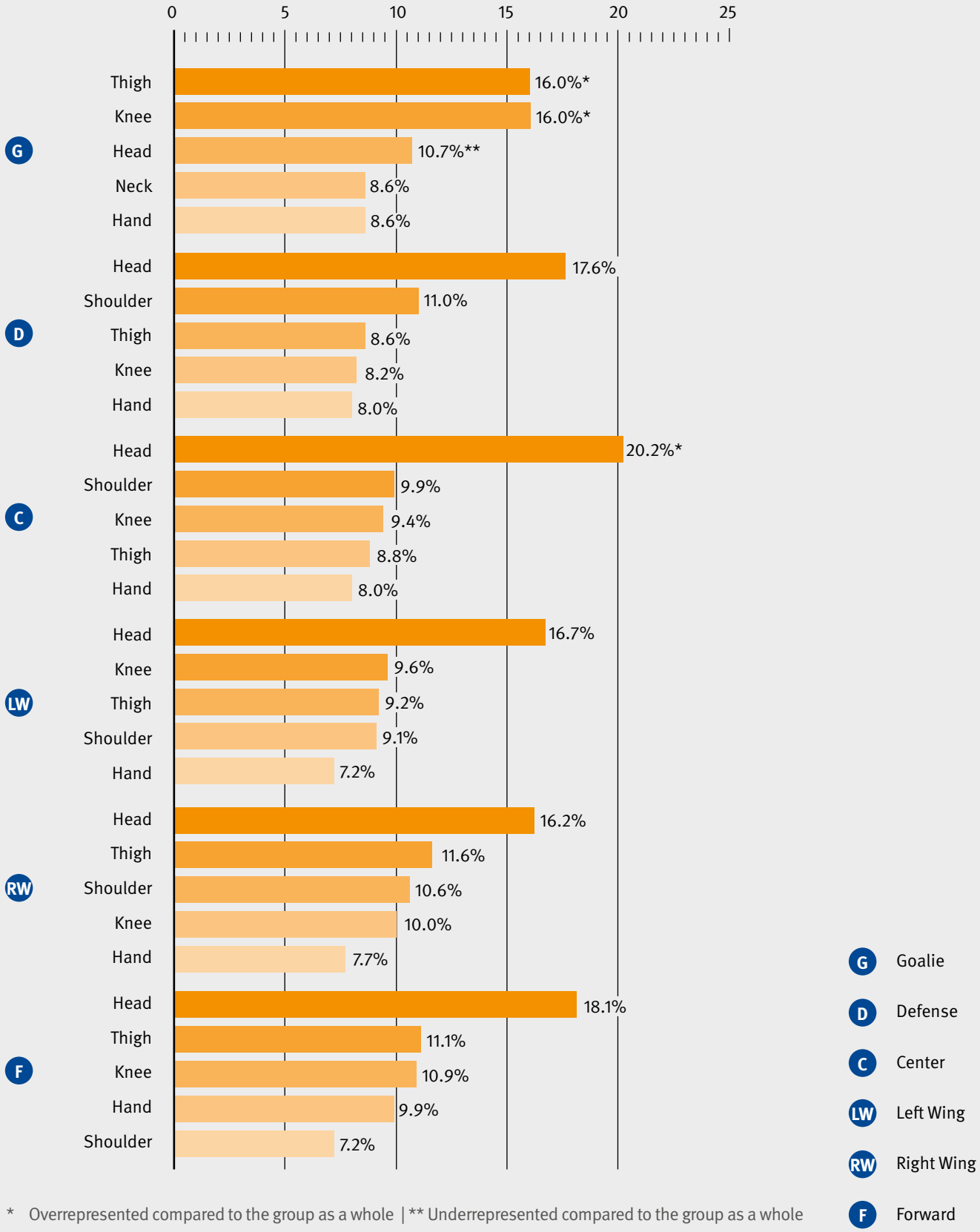
Incapacity for work in % ■ Benefits in %

Hockey


25.0
20.0
15.0
10.0
5.0
0.0
2.0%
3.0%
3.8%
3.3%
2.8%
2.8%
3.8%
4.1%
8.7%
9.1%
2.5%
1.6%
2.1%
2.0%
1.5%
1.2%
1.6%
1.5%
2,5%
3,4%
0.8%
0.6%
0.5%
0.5%
Neck
Foot
Hip
Back
Ankle
Chest
Wrist
Elbow
Lower leg
Forearm
Abdomen
Upper arm

Top 5 body regions by playing position

2014/15, 2015/16, and 2016/17 seasons (n = 5,641)[10]



* Overrepresented compared to the group as a whole | ** Underrepresented compared to the group as a whole

10 The assignment of playing positions was taken from the website https://www.rodi-db.de after the end of the respective season.

Hockey

To establish a benchmark for the two leagues under consideration, which allows a comparison of the 14 teams within each league, we have decided to calculate the relative injury burden. This is the sum of all the days missed divided by the number of official matches for each team. To exclude the risk of bias due to different reporting behavior in this calculation, only injuries subject to mandatory reporting (≥ 4 days missed) were included in calculating the relative injury burden.

Here, opposite trends are apparent for the two leagues. While the average number of days missed per official game dropped in EH1 (2 fewer days missed per official game), it increased in EH2 (one additional day missed per official game). In this context, it is also striking to note that the downtimes in EH2 are considerably longer than those in EH1. While an average of 519 days missed per team were recorded in EH1, this figure was around 26% higher in EH2. This observation is correspondingly reflected in the downtimes standardized by the official matches. While the average of days missed per official game was 8.6 in EH1, it was 10.8 in EH2.

There are considerable differences between the injury rates of the teams within the leagues and, therefore, under comparable surrounding conditions. In the 2014/15 season, the factor between the team with the lowest and the team with the highest downtime per official game was 10 in both EH1 and EH2, falling to a factor of 4 by the 2016/17 season. This, however, is not associated per se with a reduction in the injury rates. In both leagues, the base level for the team with the lowest relative injury burden increased continuously in every season. Thus, the injury burden for the team with the lowest injury rate in EH1 doubled from the 2014/15 season to the 2016/17 season and, in fact, tripled in EH2. EH2 also worsened compared to EH1 when examining the teams with the highest injury rate. While there was next to no difference between the teams of both leagues that did the poorest in this regard in the 2014/15 season, the highest relative injury burden in EH2 was double that of EH1 in the following season. In the 2016/17 season, this difference was still one and a half times.

Evidently, some teams pursue better concepts than others in the same league in regard to workload management, training design, and (medical/therapeutic) player care. It also seems that the teams in EH1 use their greater financial leeway to implement preventive measures at the team level. Reducing the causes of injury solely to the surrounding conditions, let alone blaming bad luck, does not appear valid based on the heterogeneous relative injury burden.

»An opposite trend in the leagues: a decrease in the relative injury burden in EH1 and an increase in EH2.«

Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

EH1, 2014/15, 2015/16, and 2016/17 seasons (n = 739)

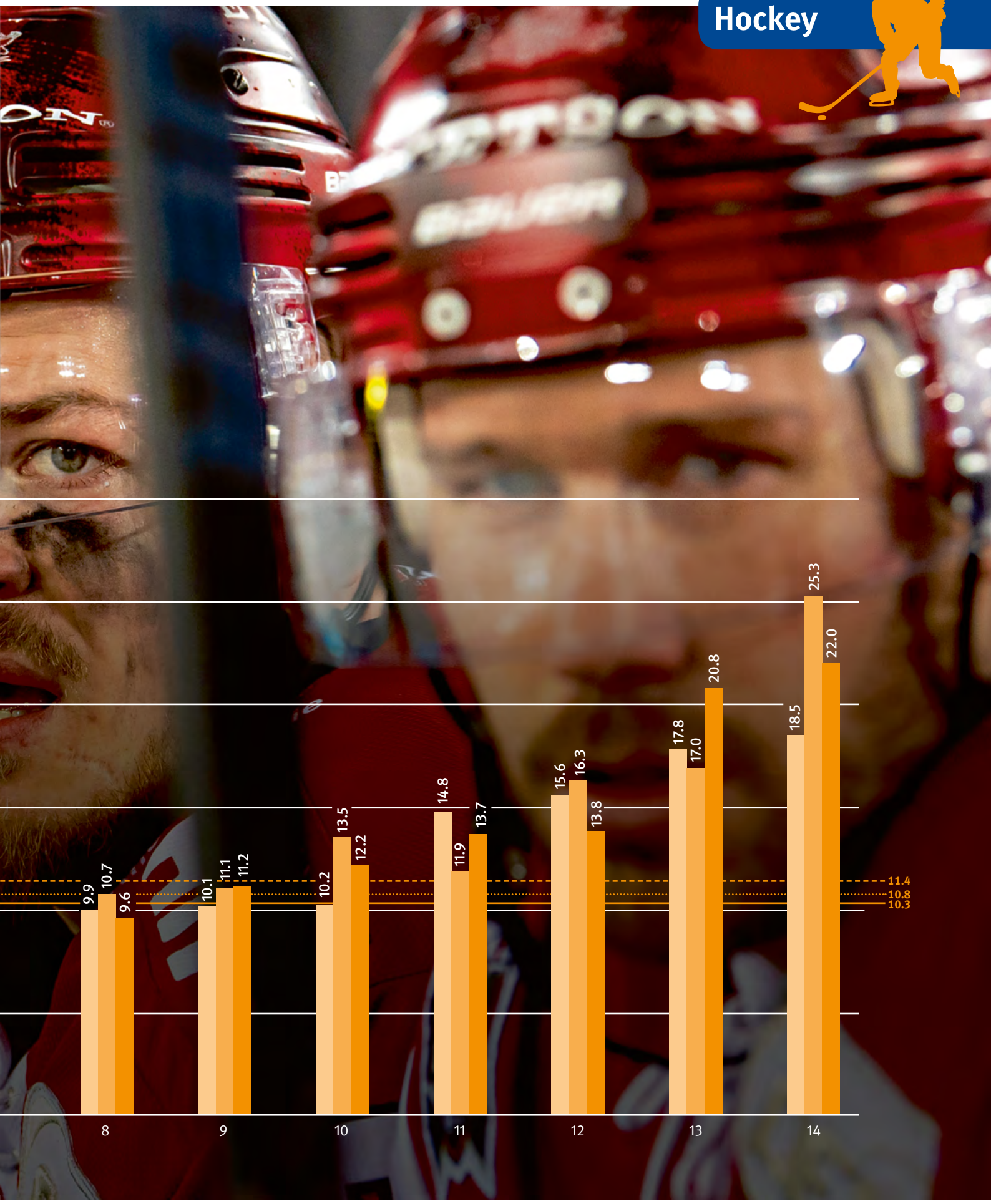
Hockey


10.2
9.1
7.4
10.3
9.3
8.1
11.0
9.8
8.8
11.7
10.2
10.2
13.4
11.1
10.9
17.0
11.3
13.7
18.2
12.9
14.1
9.7
8.4
7.9
8
9
10
11
12
13
14

Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

EH2, 2014/15, 2015/16, and 2016/17 seasons (n = 697)

Hockey


9.9
10.7
9.6
10.1
11.1
11.2
10.2
13.5
12.2
14.8
11.9
13.7
15.6
16.3
13.8
17.8
17.0
20.8
18.5
25.3
22.0
11.4
10.8
10.3
8
9
10
11
12
13
14

Key insights and lessons learned for prevention

Considerable differences in the relative injury burden between teams in the same league prove that a reduction in the days missed is possible in principle.

The qualitative and quantitative sports science, medical, and physiotherapy care provided to the players seems to vary considerably between teams.

»Notwithstanding a decrease, head injuries remain the number 1 injury hot spot.«

Hockey

A significant decrease in the injury incidences in hockey (especially in EH1) underscores the prevention potential for successful injury reduction.

- The teams must continue creating surrounding conditions for the lasting establishment of a prevention concept in the team. This need seems to be greater in EH2.

The proportion of head and shoulder injuries is declining. Nevertheless, both remain among the top 3 injury hot spots in hockey.

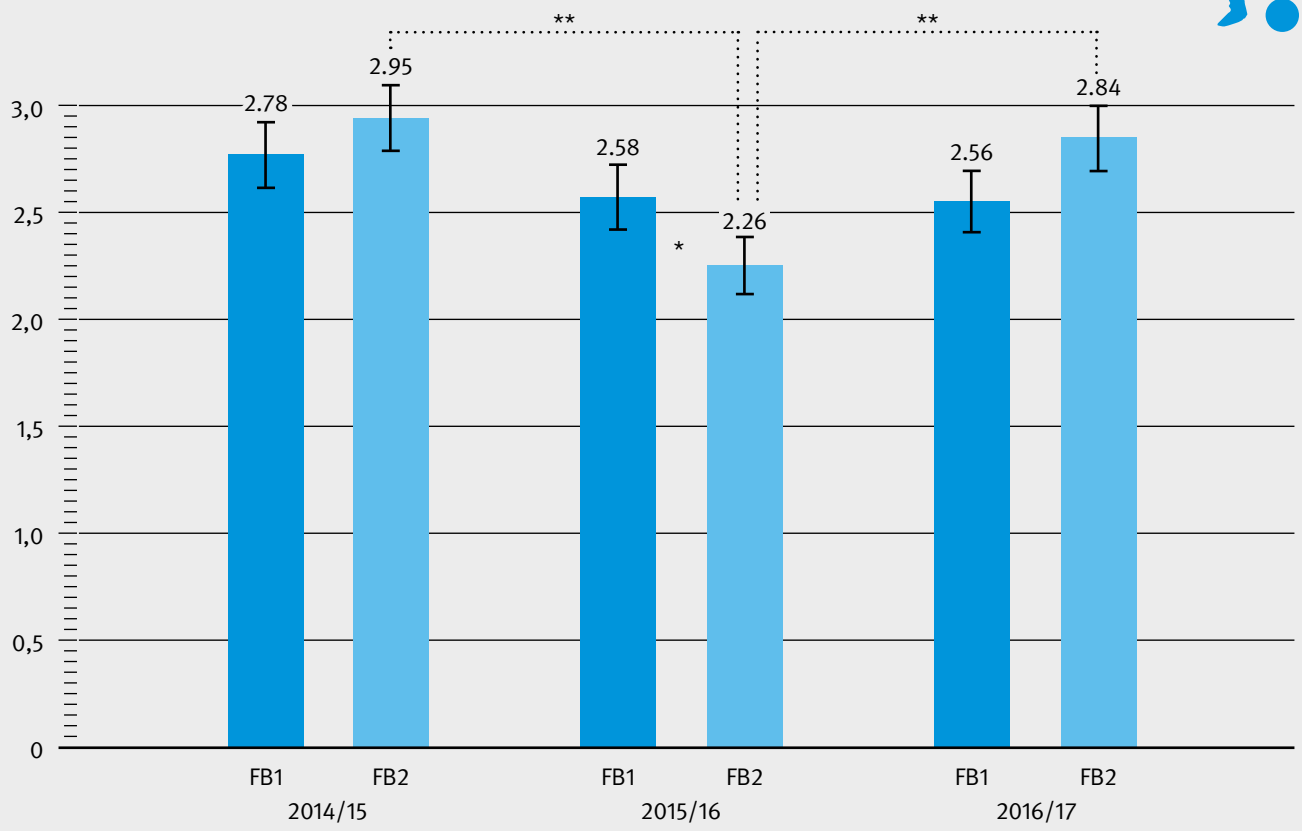
- Impact-reduction boards could support this positive trend going forward. Shoulder control exercises as well as contact and fall training should be part of preventive training measures.

8 Injuries in soccer

Soccer

Cumulative season incidence by league and season

2014/15, 2015/16, and 2016/17 seasons (n = 3,047); ±95% confidence interval



* Statistically significant difference in league comparison

** Statistically significant difference in season comparison

As described in the section comparing the sports, soccer is the sport with the least severe injuries across all three examined seasons (measured by the average days missed), but at the same time, it is also the sport with the highest injury prevalences, cumulative season incidences, and total days missed.

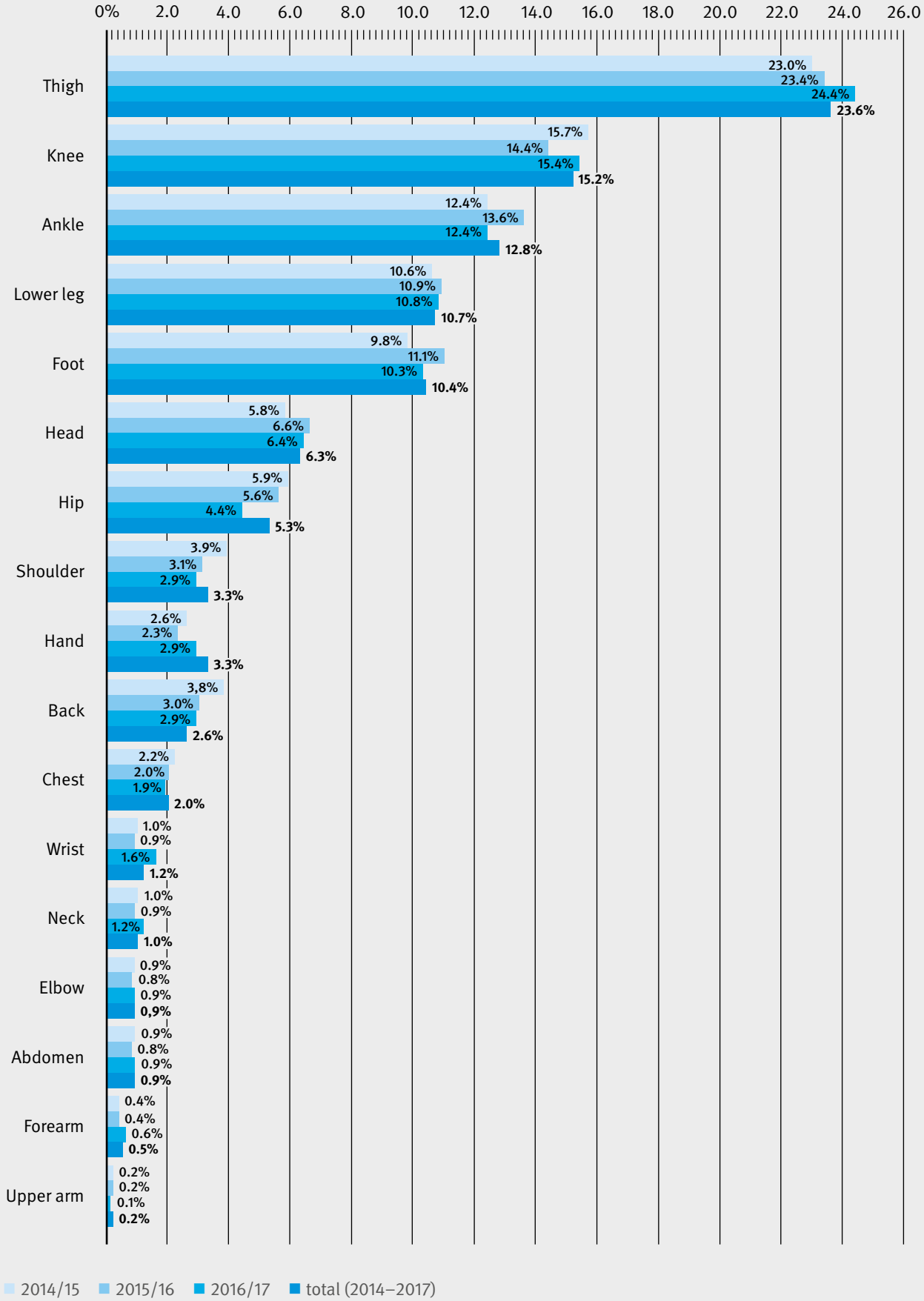
Here, 2015/16, the second season in the observation period, stood out, with significantly lower recorded injury rates compared to 2014/15 and 2016/17. As already discussed in the special section, a link is suspected between the higher injury rates and the major international tournaments—the FIFA World Cup 2014 in Brazil and the UEFA European Championship 2016 in France—leading up to the respective seasons.

However, examining the cumulative season incidences in the league comparison shows that the significant decrease in 2015/16 can be explained mainly by the lower injury rates in FB2. Aside from the statistically significant lower incidence rates in the season comparison, the FB2 injury rate is below that of FB1 for the first time in the 2015/16 season. Since it can be expected that more national players in FB1 participated in the international tournaments, a direct link between the injury rates and the higher number of official matches due to the tournaments appears rather unlikely.

»The cumulative season incidences in soccer are significantly higher in seasons after international tournaments.«

Distribution of injuries by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 7,493)



Soccer

The summer break between the last match day of the previous season and the first match day of the season under review was 104 days (FB1) and 82 days (FB2), respectively, before the 2014/15 and 2016/17 seasons, the latter being the season with significantly higher injury rates. Leading up to the 2015/16 season, in which the injury rates in FB2 in particular were significantly lower, this period with 82 days (FB1) and 61 days (FB2), respectively, was around 3 weeks shorter in both leagues. It is therefore inaccurate to generally speak of a shorter summer break in the years of the international tournaments.

Also in view of the acute/chronic workload model, the link between international tournaments and subsequent higher injury rates in team soccer could therefore more likely be found in comparatively long breaks, with a low chronic workload among the players who were not nominated for the national team, along with very short recovery phases with a high chronic workload among the national team players.

Possibly, this heterogeneous initial situation with different training starts and stress conditions is what poses workload management problems for the teams. One reason why this leads to greater problems in FB2 than in FB1 may be found in FB2's lower budgets, resulting in less staff and poorer technical support for the athletes, which makes individualized workload management more difficult. The overall comparatively high injury rates in FB2 compared to FB1, notwithstanding a considerably lower competition density throughout the season, could be evidence of this as well.

Examining the distribution of injuries by the various body regions confirms that the lower limbs represent the biggest problem by far in soccer, with more than three-quarters of all injuries.

Thigh, knee, and ankle injuries lead the field in all three seasons, by themselves accounting for more than half of all injuries. While knee and ankle injuries changed by the same amount but in opposite directions in the longitudinal study, with a noticeable decrease/increase in the second season compared to the first and third seasons, the proportion of thigh injuries increased by 1.4 percentage points overall across all the three seasons. Not least for that reason, the VBG will increasingly engage itself in prevention and the return-to-competition process for thigh muscle injuries in the coming year.

Head injuries, with an average of 6.3%, are the most frequent injuries in professional soccer, after the lower-limb injuries discussed above. Mainly due to the (potentially) fatal consequences, head injuries have been a key issue for the VBG for many years. Most recently, discussions with the medical commission of the german soccer association (DFB) and the german soccer league (DFL) led to the mandatory introduction of baseline testing for all FB1 and FB2 players by the DFL, starting with the 2019/20 season. This examination leading up to the season is helpful for identifying the extent of a later injury and, consequently, for providing better treatment to the player.

Fundamentally however, a sweeping generalization of the distribution of injuries among the individual body regions in the sport of soccer is impossible. It turns out that the individual positions' requirement profiles have an influence on injuries: For instance, goalkeepers—who must frequently intervene in highly critical game situations with the head down low, for example, when running a

»The relative proportion of thigh injuries has increased continuously in the three seasons that were observed.«

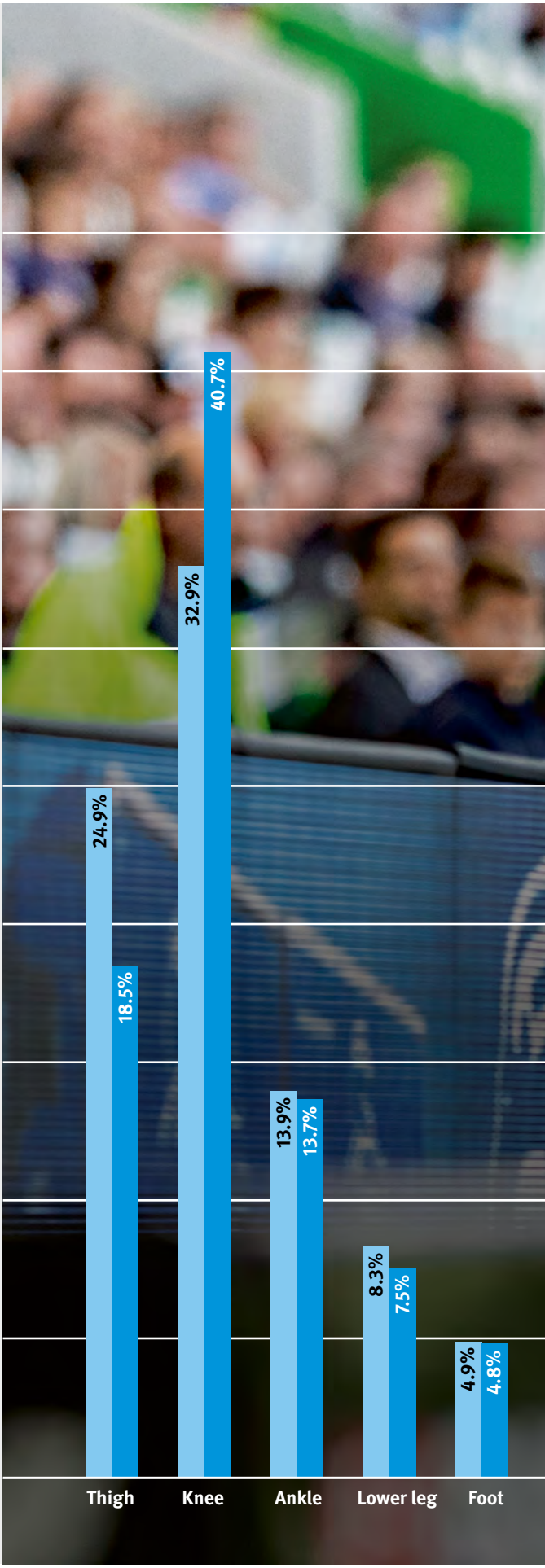
Downtime and costs by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 7,493)

through ball or intercepting a ball in—suffer head injuries significantly more often than field players but suffer considerably fewer thigh injuries, which is expected due to shorter running distances and fewer passing and shooting actions. Conversely, centers, with numerous ball actions and frequent dribbling, suffer more ankle injuries than all other position groups.

Aside from the frequency as such, the severity of injury constitutes another relevant parameter for prioritizing the need for preventive countermeasures. The severity of an injury can be readily quantified based on the resulting downtime and incurred costs. Both categories show that knee injuries account for the greatest burden by far: They result in nearly one-third of the days missed and more than 40% of all benefits. But thigh injuries, which cause around one-quarter of the incapacity for work and 18.5% of the costs, also underscore the tremendous need for productive prevention approaches in soccer.

»The top 3 injuries cause more than 70% of all the days missed and benefits.«



Soccer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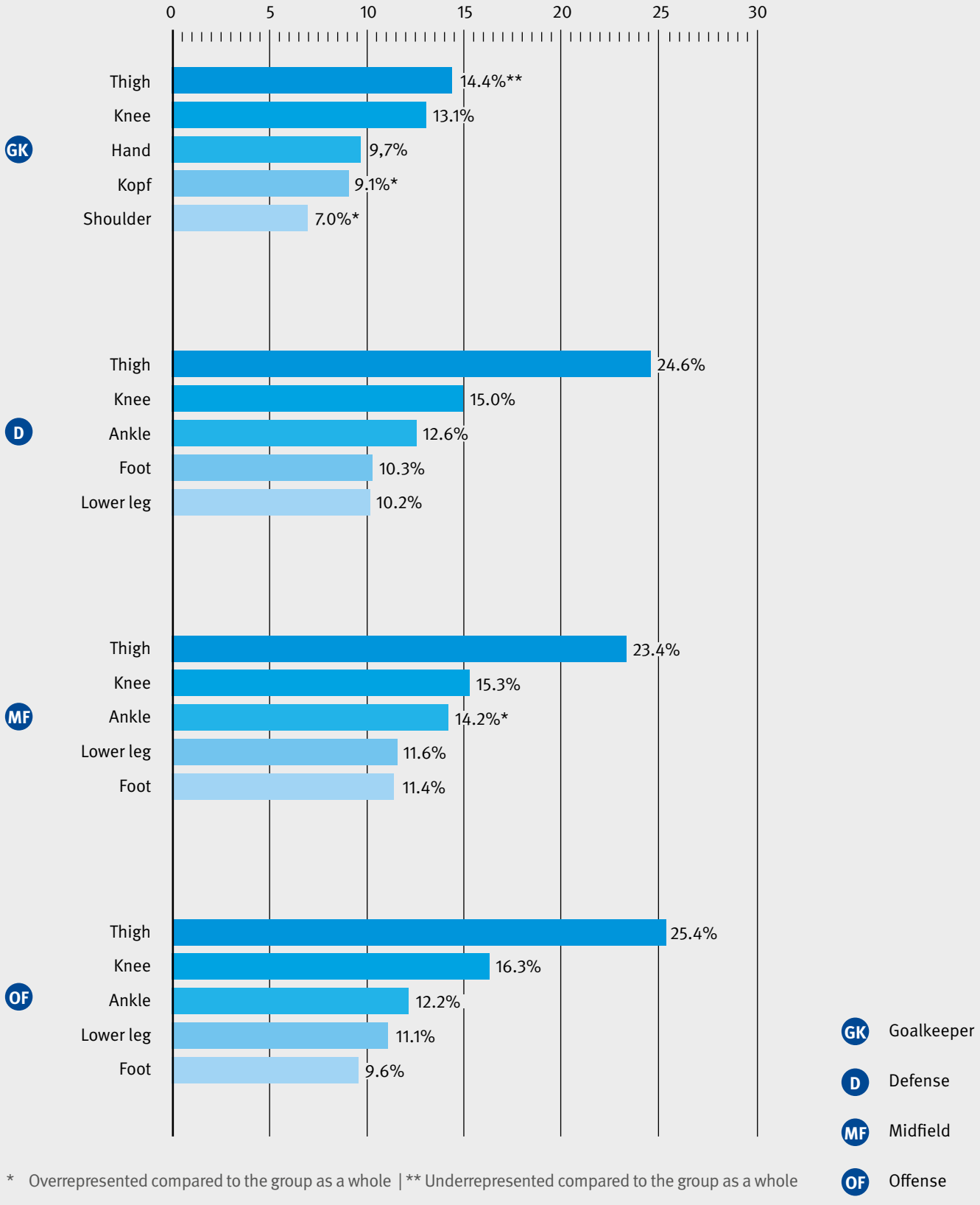
Top 5 body regions by playing position

2014/15, 2015/16, and 2016/17 seasons (n = 5,641)[11]



* Overrepresented compared to the group as a whole | ** Underrepresented compared to the group as a whole

11 The assignment of playing positions was taken from the websites https://www.kicker.de and https://www.transfermarkt.com after the end of the respective season.

Soccer

To establish a benchmark for the two examined leagues that permits a comparison of the 18 teams within the respective league, we decided to calculate the relative injury burden. This is the sum of all the days missed divided by the number of official matches for each team. To exclude the risk of bias due to different reporting behavior in this calculation, only injuries subject to mandatory reporting (≥ 4 days missed) were included in calculating the relative injury burden.

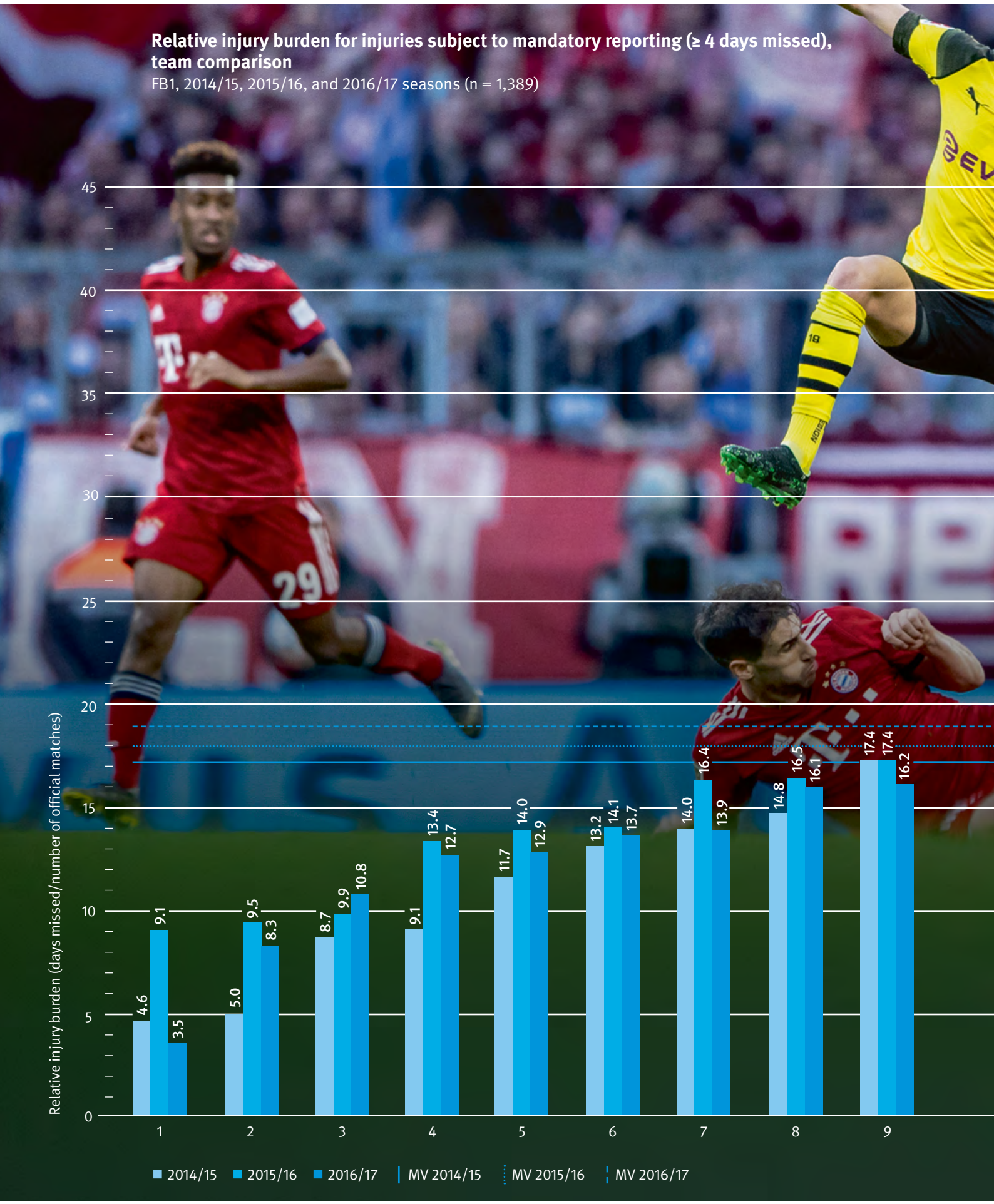
The calculation shows that there is a factor of 3.8 to 12.6 in FB1 and 6.1 to 14.3 in FB2 between the team with the lowest and that with the highest downtime per official game, depending on the season. These glaring differences within a league and, therefore, under comparable surrounding conditions show that a reduction in the injury rates is possible—even under the conditions in professional soccer.

Evidently, some teams pursue better concepts than others in the same league in regard to workload management, training design, and (medical) player care. Reducing the causes of injury solely to the surrounding conditions, let alone bad luck, does not appear valid here.

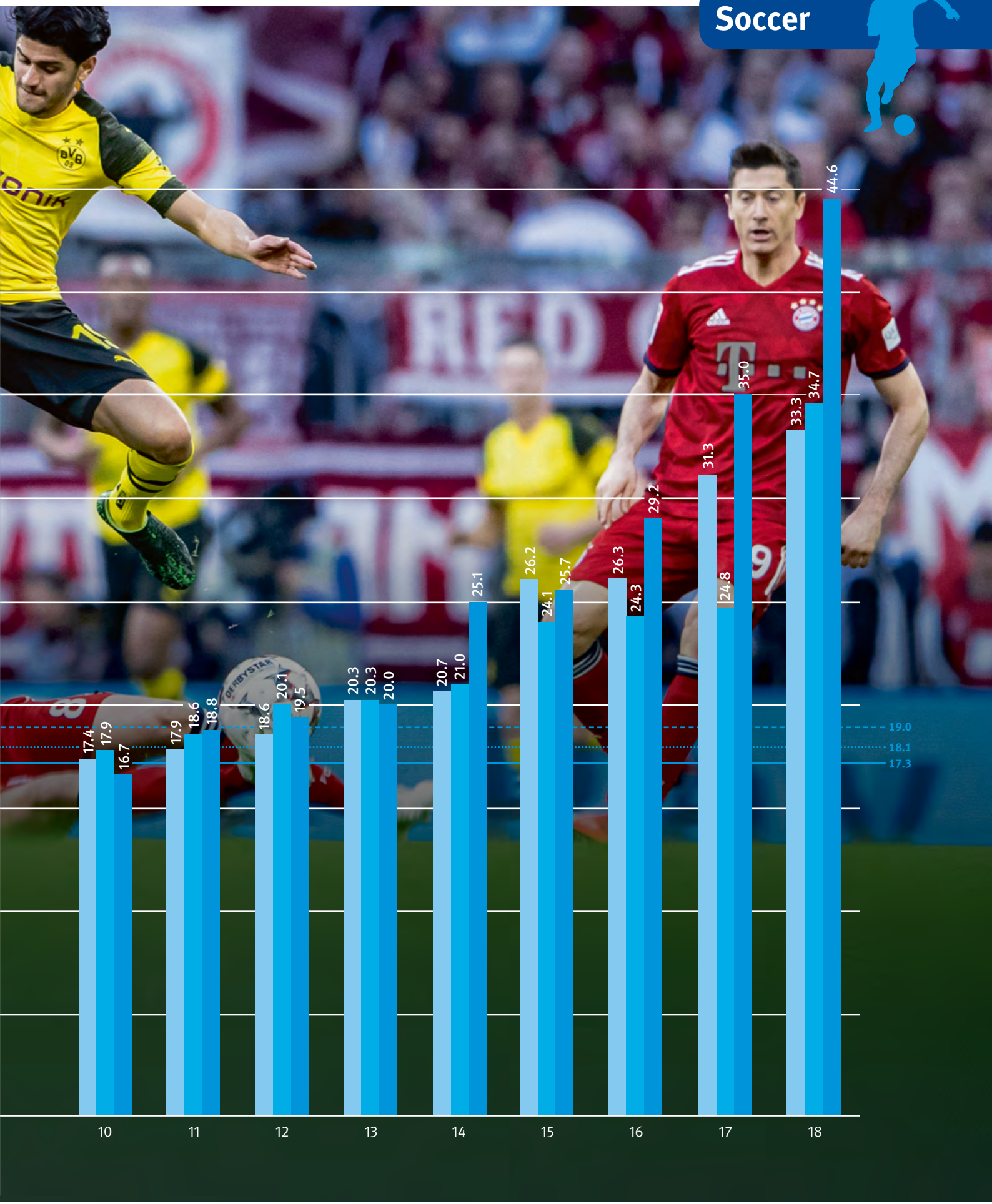
»A position's requirements profile influences the injury profile of the individual playing that position.«

Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

FB1, 2014/15, 2015/16, and 2016/17 seasons (n = 1,389)



Soccer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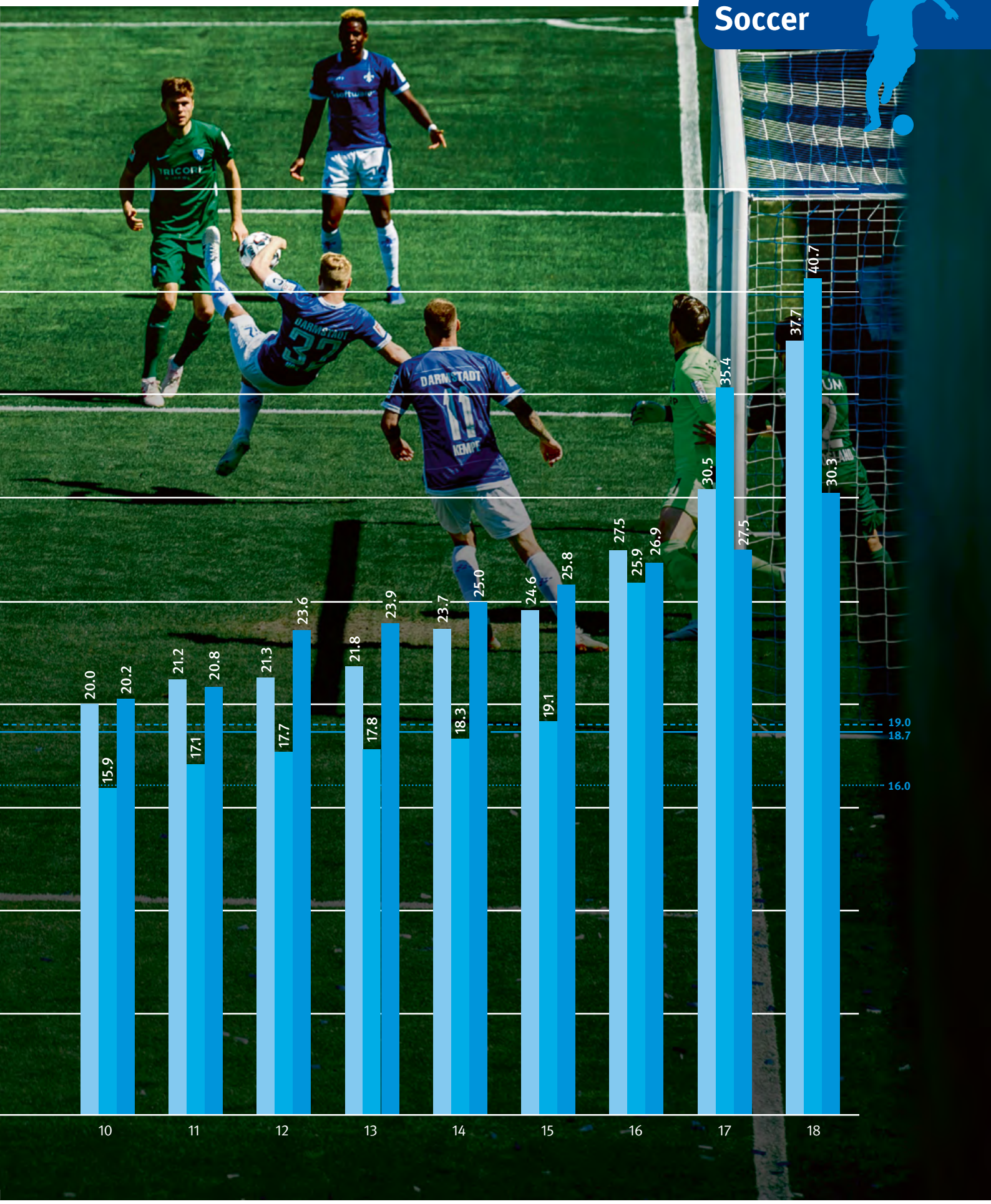
Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

FB2, 2014/15, 2015/16, and 2016/17 seasons (n = 1,201)

Soccer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Key insights and lessons learned for prevention

Higher injury rates in seasons after major international tournaments are cause to suspect that shorter breaks increase the risk of injury.

- Individual workload management is particularly relevant in the corresponding seasons.

»There are considerable differences in the relative injury burden between teams within the same league.«

Soccer

Considerable differences in the days missed between teams in the same league prove that a reduction in the days missed is possible in principle.

- The qualitative and quantitative training science, medical, and physiotherapy care for the players appears to very considerably.

The proportion of thigh injuries increased by 1.4 percentage points within the three seasons; here, the proportion of direct contact injuries is less than 15%.

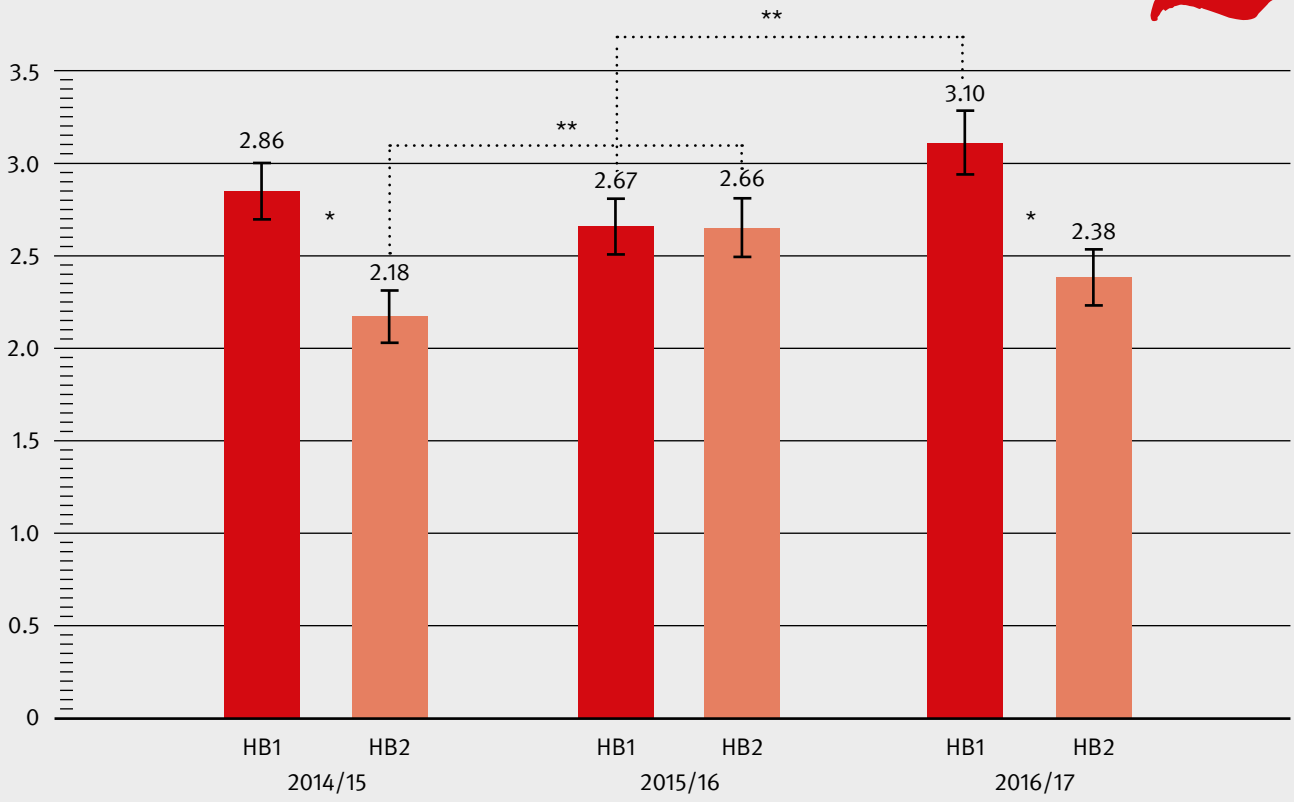
- Preventive screening, training management, training design, and objective return-to-competition protocols are highly relevant for primary and secondary injury prevention.

9 Injuries in handball

Handball

Cumulative season incidence by league and season

2014/15, 2015/16, and 2016/17 seasons (n = 3,047); ±95% confidence interval



* Statistically significant difference in league comparison
** Statistically significant difference in season comparison

A continuous increase in the cumulative season incidences and league incidences can be observed in handball across all three examined seasons. With an average of 2.7 injuries per player and season, handball shares the inglorious lead with soccer.

In the longitudinal study, the 2016/17 season stands out, with a significantly higher injury rate compared to the 2014/15 season. It is the season with the second-highest injury rate in the overall examination of all four sports.

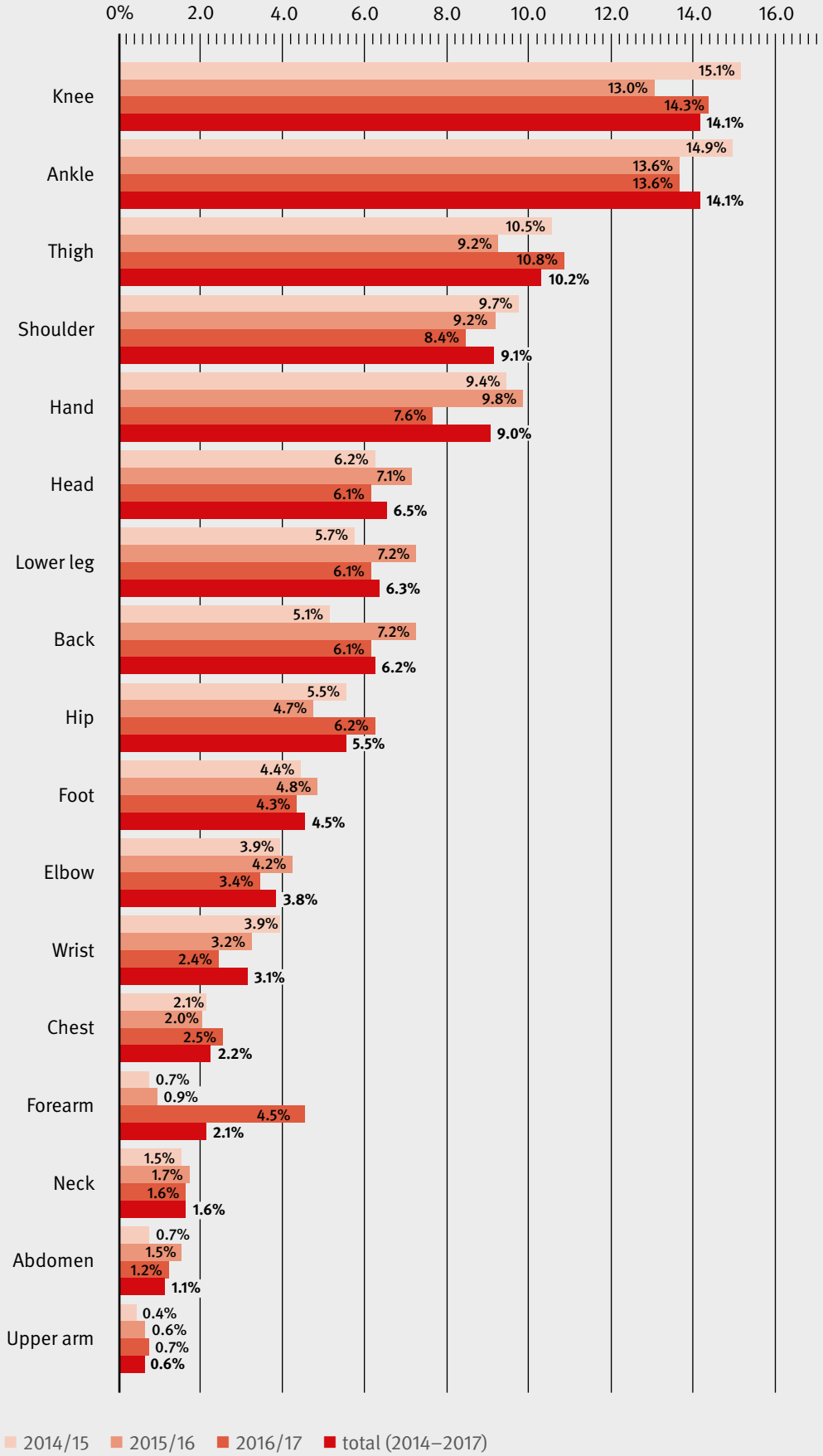
This negative peak value is due in particular to the significant increase in injury rates in HB1. On average, every HB 1 handball player suffered 3.1 injuries in the 2016/17 season. One possible cause may be the 2016 Olympic Games, which made meaningful preparation for the season more difficult for many first-league players. Typically, the second league is less affected by this. Another possible cause is that 18 teams once again participated in league matches after the withdrawal of a team due to insolvency in the previous season (starting with the second half of the 2015/16 season).

The significant increase in injuries in HB2 during the 2015/16 season may be due to the increase in the second league's size to 21 teams, with the associated introduction of double headers. Notwithstanding the participation of federal league teams in European competitions and more time spent in the DHB Cup, the competition exposure in the 2015/16 season was about 15% greater in

»The cumulative season incidences and league incidences increased continuously across the three seasons.«

Distribution of injuries by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 6,054)



Handball

HB2 than in HB1. Thus, the total number of days missed in handball was also significantly higher in the 2015/16 season than in the previous season.

The reduction of HB2 to 18 teams starting with the 2019/20 season and the associated reduction in competition exposure therefore constitute a good step from the perspective of prevention. Extending the summer break and introducing the 72-hour rule, a break of at least 72 hours between two consecutive matches, are currently being discussed as well. The resulting longer preparation and regeneration times could make an important contribution to injury reduction.

The tracking system in HB1 introduced by the German Handball League for the 2019/20 season is intended to further boost awareness among the teams, encouraging them to examine their players' performance data, especially the external load, and to implement individualized workload management tailored to that.

Notwithstanding a slight decrease in the longitudinal view for knee (-1%) and ankle injuries (-4%), these are the body regions most frequently affected by injuries in handball. Thigh injuries, conversely, increased by 8% and rank in third place. The greatest percentage change notwithstanding the low proportion of all injuries was observed for forearm injuries (+571%).

When the downtime and benefits caused by handball injuries are examined as indicators for the possible severity of injury in addition to the frequency as such, knee injuries emerge as the greatest problem in handball.

Slightly more than one-third of the days missed (36.9%) and benefits (35.1%) are due to knee injuries. As previously described in the focus section of the VBG Sports Report 2018, the risk of anterior cruciate ligament rupture is consequently greatest in handball as well.

Ankle (13.9% of days missed, 11.9% of benefits) and shoulder injuries (11.5% of days missed, 13.5% of benefits) emerge as additional injury hot spots. Together, these three injury hot spots account for nearly two-thirds of the days missed (62.3%) and benefits (60.5%). A 9% decrease in shoulder injuries in the longitudinal view is a positive observation.

It is also striking that the highest number of total days missed was recorded in the 2015/16 season, even though the number of injuries in the previously mentioned body regions was lowest in this season. This is remarkable insofar as knee and shoulder injuries in particular are associated with longer downtimes as a rule.

While hip injuries occurred considerably more often in HB1 (6.5%) than in HB2 (4.4%), ankle (HB1: 12.8%; HB2: 15.4%) and foot injuries (HB1: 3.6%; HB2: 5.5%) were overrepresented in HB2.

»The season comparison shows that competition exposure has a considerable influence on injuries.«

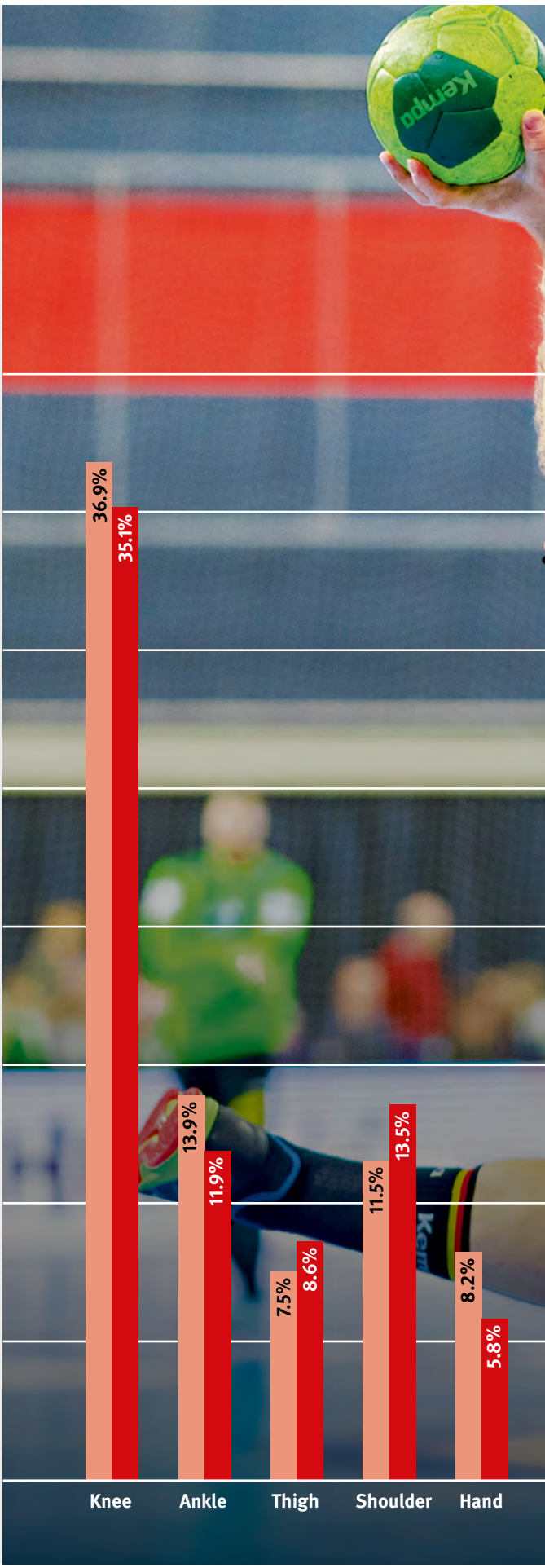
Downtime and costs by body regions

2014/15, 2015/16, and 2016/17 seasons (n = 6,054)

Noticeably more head (8.5%), neck (2.7%), and elbow injuries (5.1%) were recorded among pivot player than in the group as a whole. Presumably, the pivot player position's specific requirements profile is partly responsible for this, being associated on one hand with the highest number of duels and collisions with regular as well as irregular body contact (risk of head and neck injury) and on the other hand with the largest number of dive shots (risk of elbow injury).

Wing players sustain fewer head injuries but significantly more frequent ankle injuries (significant for outside left, trend for outside right). This is likely due mainly to jumps and landings during outside corner shots. Often, an opposing player runs down the wing player, movement associated with a risk of foot–foot collision, or there is interference contact in the air, where the subsequent landing in the goalmouth constitutes a critical situation.

»Knee, ankle, and shoulder injuries are the top 3 injury hot spots and account for nearly two-thirds of the days missed and benefits.«



Handball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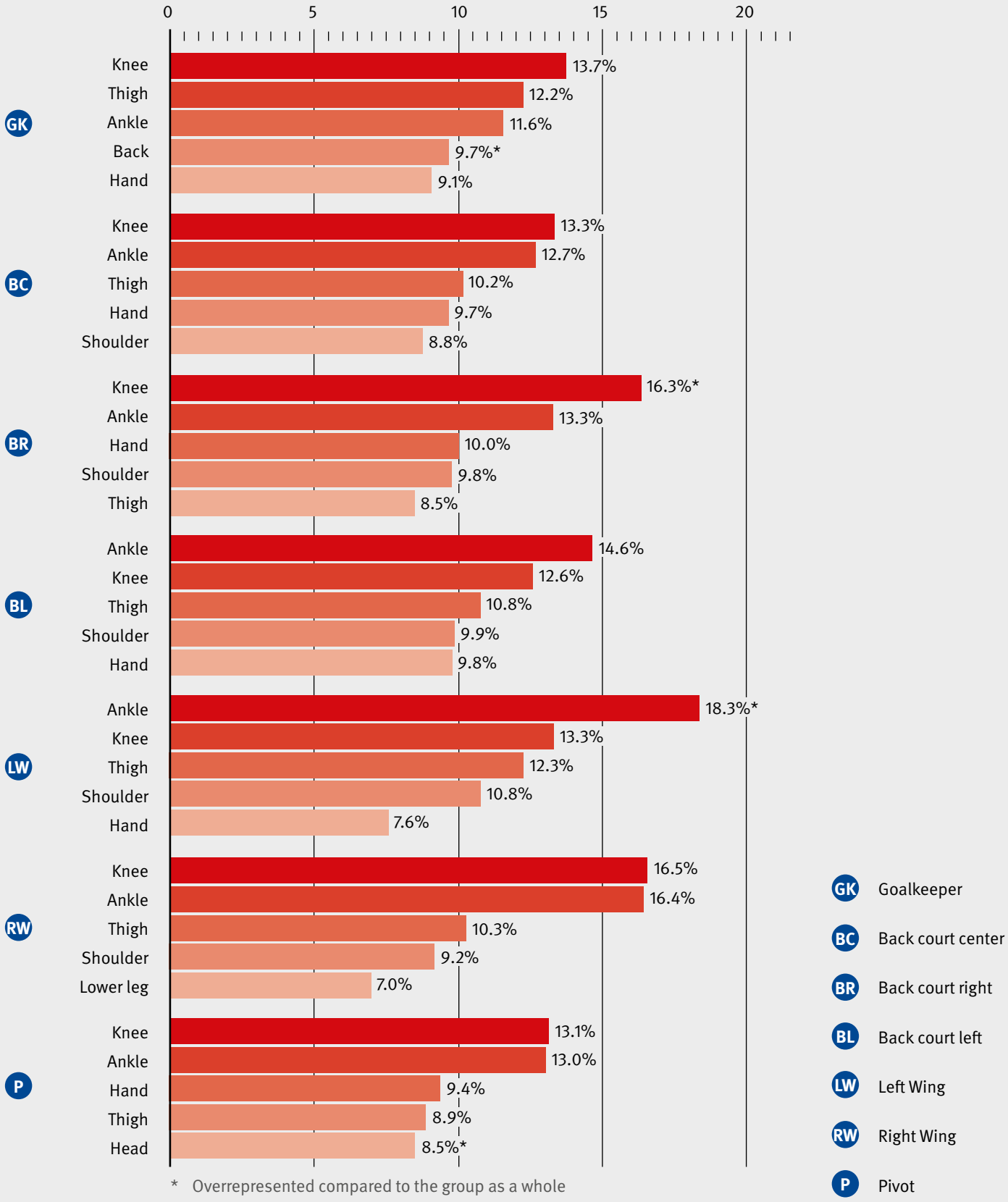
Forearm
Neck
Abdomen
Upper arm

Top 5 body regions by playing position

2014/15, 2015/16, and 2016/17 seasons (n = 6,054)[12]



12 The assignment of playing positions was taken from the website https://www.liquimoly-hbl.de after the end of the respective season.

Handball

To establish a benchmark for the two examined leagues that permits a comparison of the 18 teams within the respective league, we decided to calculate the relative injury burden. This is the sum of all the days missed divided by the number of official matches for each team. To exclude the risk of bias due to different reporting behavior in this calculation, only injuries subject to mandatory reporting (≥ 4 days missed) were included in calculating the relative injury burden.

The average number of days missed per official game increased slightly in both leagues compared to the initial 2014/15 season (about 1 more day missed per official game). Examining the average days missed per team and season as well as the average days missed per official game reveals virtually no difference between the two leagues.

It is, however, striking that players in HB2 miss an average of five more days than their colleagues in HB1 (HB1: 25 days; HB2: 30 days). On one hand, this may be due to greater performance pressure in HB1, causing injured players to return to the playing field sooner. On the other hand, the medical and physiotherapy care in HB2 may be poorer due to scarcer financial resources.

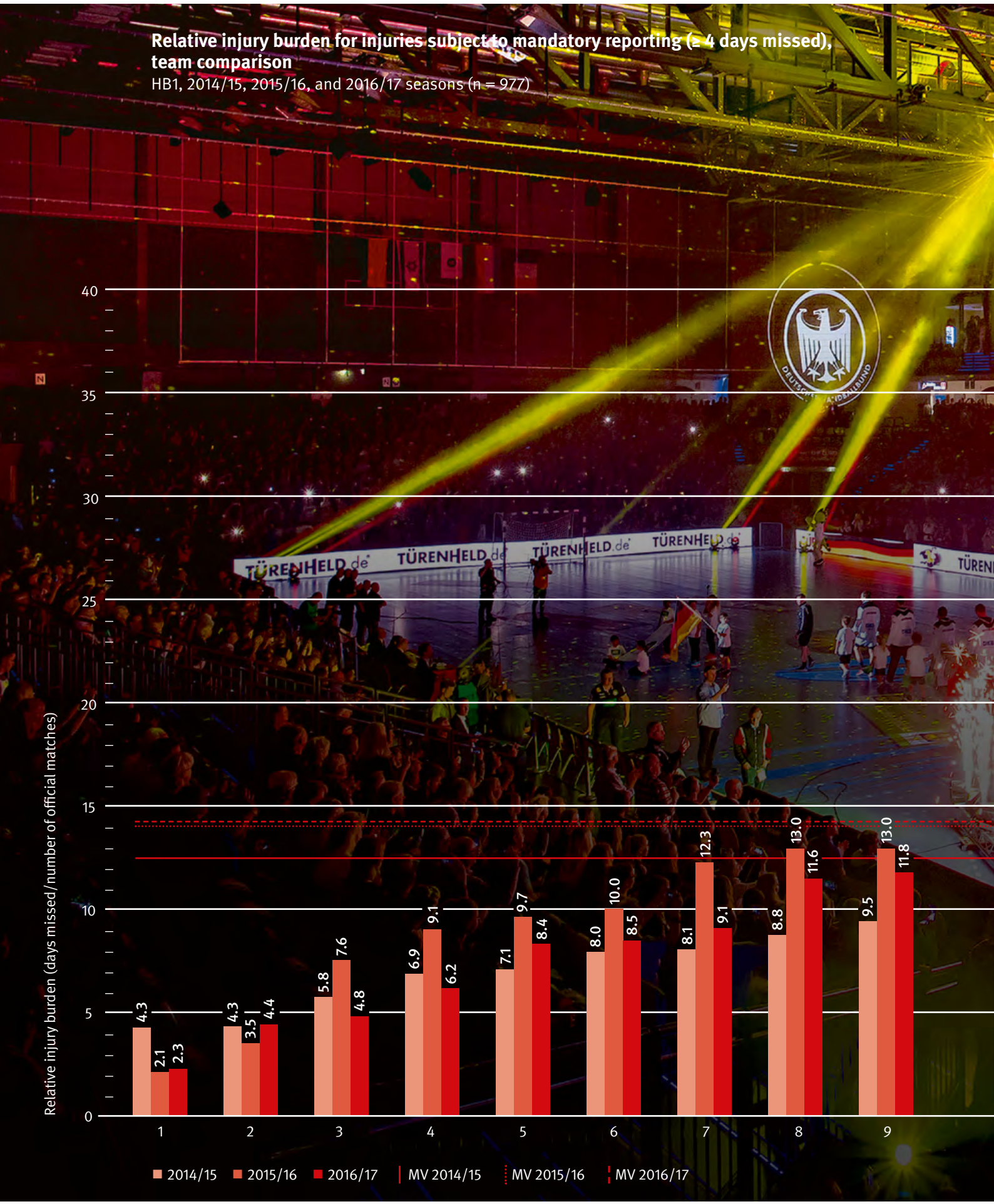
The considerable differences in the injury rates between teams are especially striking. There is a factor of 7 to 15 between the team with the lowest and that with the highest downtime per official game in HB1, depending on the season. This difference is even greater in HB2, where the team that performed the poorest in this context reports between 8 and 41 times higher downtimes due to injuries than the best team in this category. In both leagues, this differential increased continuously across the three seasons. This factor doubled in HB1 and actually increased fivefold in HB2.

Evidently, some teams pursue better concepts than others in the same league in regard to workload management, training design, and (medical/therapeutic) player care. Reducing the causes of injury solely to the surrounding conditions, let alone blaming bad luck, does not appear valid based on the heterogeneous relative injury burden.

»Position-specific injury hot spots illustrate the need for individualized preventive measures.«

Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

HB1, 2014/15, 2015/16, and 2016/17 seasons (n = 977)



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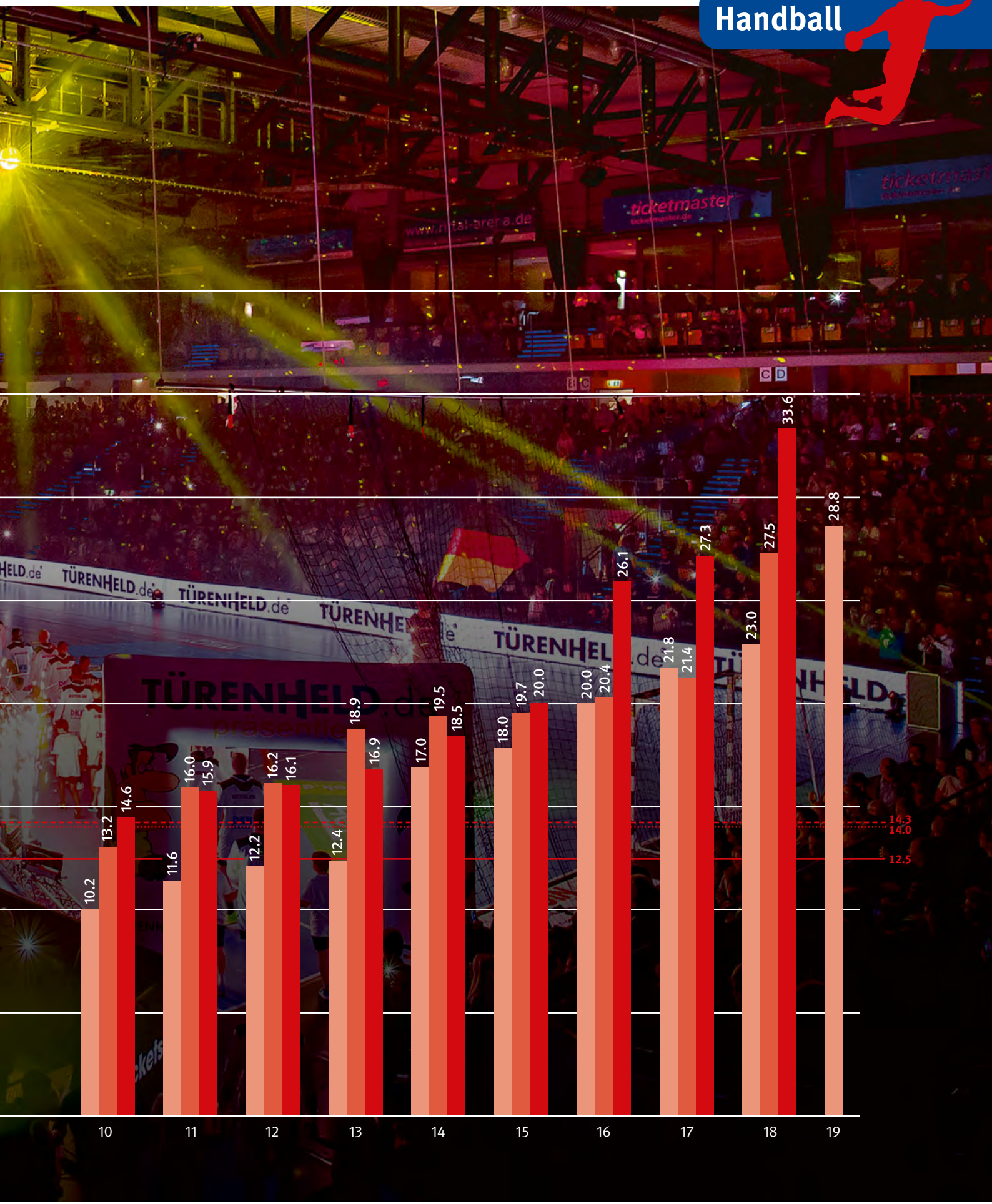
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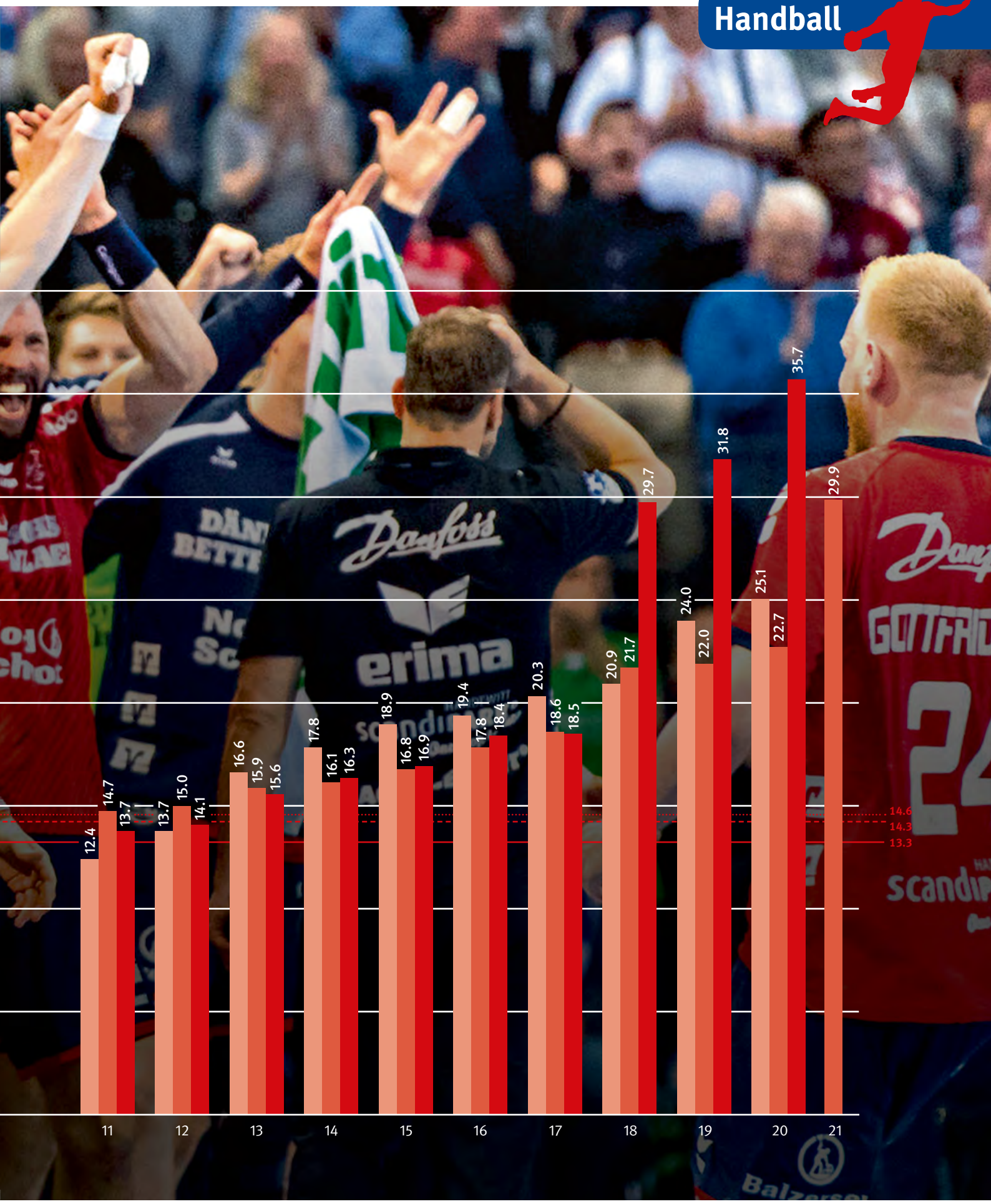
Relative injury burden for injuries subject to mandatory reporting (≥ 4 days missed), team comparison

HB2, 2014/15, 2015/16, and 2016/17 seasons (n = 1,000)

Handball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Key insights and lessons learned for prevention

»There is a pronounced imbalance in the relative injury burden within the leagues, especially in HB2.«

Handball

Considerable differences in the relative injury burden between teams in the same league prove that a reduction in days missed is possible in principle.

The qualitative and quantitative sports science, medical, and physiotherapy care provided for the players seems to vary considerably between teams.

The increase in the season incidences, especially in the 2016/17 season including two additional major events (the Olympic Games and World Handball Championships), illustrates the competition calendar's pronounced influence on injuries.

Coordination of the international and national competition calendars must be optimized. This would avoid conflicts in the playing schedule and simultaneously result in longer preparation and regeneration times.

Knee injuries are the number 1 injury hot spot in handball.

Here, preventive screenings, individualized training measures, and optimized training management are highly relevant for primary injury prevention. Objective return-to-competition protocols prevent athletes from resuming day-to-day training too soon after an injury, thereby reducing the risk of recurrence.


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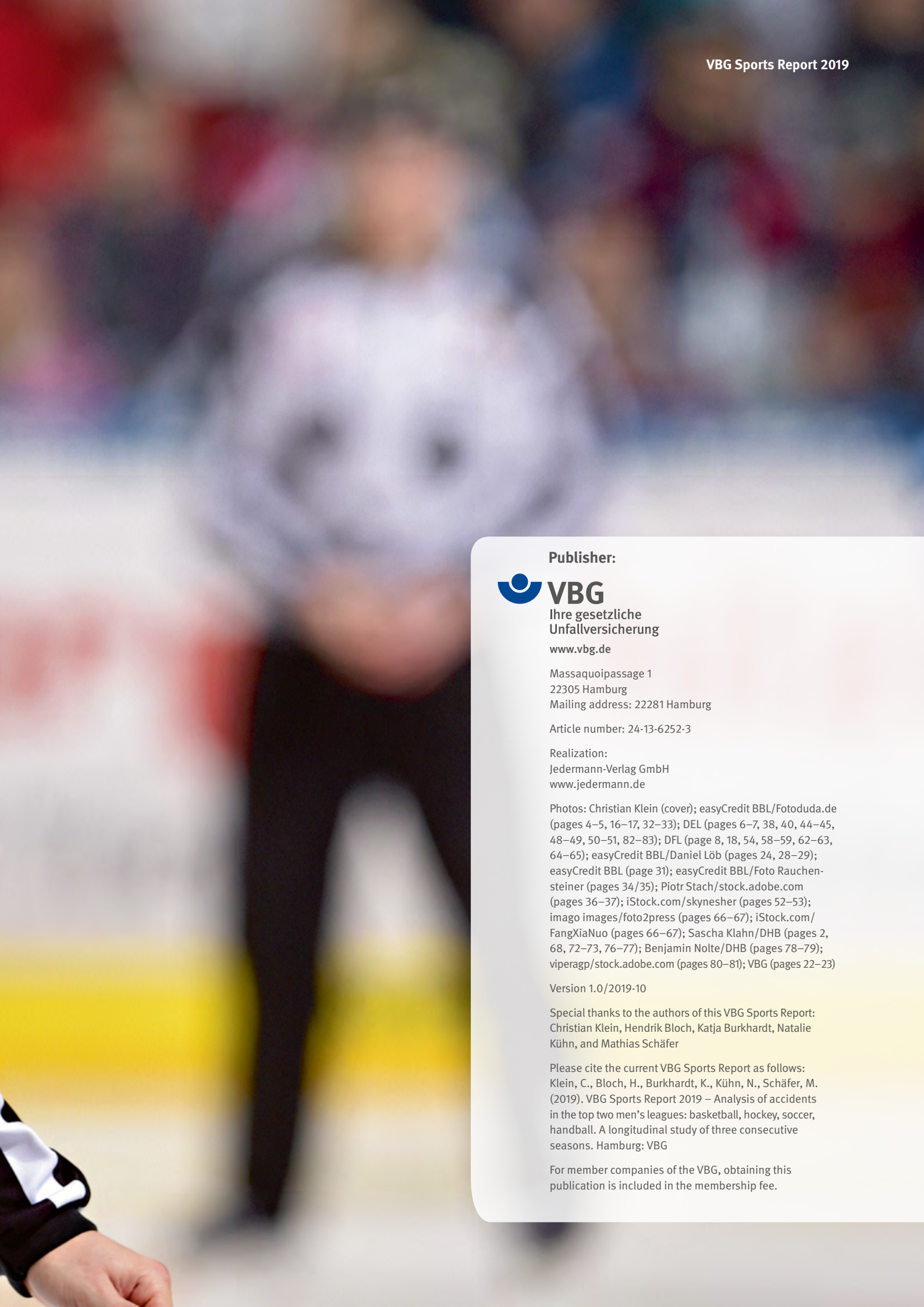

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